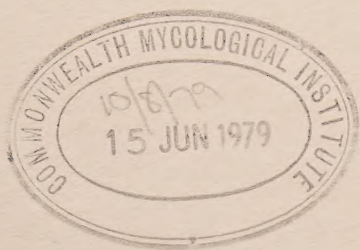


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ANNUAL REPORT

DEPARTMENT OF
AGRICULTURAL TECHNICAL SERVICES

1 JULY 1977 TO 30 JUNE 1978



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REPUBLIC OF SOUTH AFRICA

ANNUAL REPORT

1 July, 1977 to 30 June, 1978

of the

**Secretary for
Agricultural Technical Services
for the period
1 July, 1977 to 30 June, 1978**

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**Report of the Secretary for Agricultural
Technical Services for the period
1 July, 1977 to 30 June, 1978**

**THE HONOURABLE THE MINISTER OF AGRICULTURE,
PRETORIA**

SIR,

I have the honour to submit herewith the Annual Report of the Department.

Secretary for Agricultural Technical Services

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I. Introduction

In view of my approaching retirement from the post of Secretary for Agricultural Technical Services, which I have held for seven years, I should like to take this opportunity to review some of the most important events and achievements of the seventies in this chapter of the Annual Report.

The functions of the Department of Agricultural Technical Services fall into three broad categories, namely:

- Regulatory and general services
- Agricultural research
- Farming and agricultural resource development

REGULATORY SERVICES

The administration of the following new legislation has been assigned to the Department since 1971:

The Subdivision of Agricultural Land Act of 1970, the Agricultural Pests Act of 1973, the Groot Constantia State Estate Control Act of 1975, the Plant Breeders' Rights Act of 1976, the Plant Improvement Act of 1976 and the Livestock Improvement Act of 1977.

In addition to administering the above new or recently revised legislation, the Department is responsible for 13 other important Acts, some of which, such as the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act of 1947, and the Wine, Other Fermented Beverages and Spirits Act of 1957, were also amended during the seventies.

The drafting and administration of legislation are the responsibility of two subdivisions at Head Office. As the name indicates, the Legislation and Parliamentary Subdivision, which was established in 1973, deals with the drafting of Acts and regulations and assists the Head of Department during Parliamentary sessions. During the past two years this Subdivision was responsible for drawing up 78 proclamations, a number of sets of regulations, and Government notices, which were published in the *Government Gazette*.

The Statutory Control Subdivision of the Department is responsible for the administration of legislation and has remained virtually unchanged during the past few years. This Subdivision was established in 1970. Its staff has been strengthened *ad hoc* and proposals have been submitted to the Public Service Commission for the creation of a number of key posts for inspectors under the

Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act. This will make it easier to exercise more effective control.

This Subdivision has recently been given the additional responsibility of administering the Livestock Improvement Act of 1977. This includes duties such as organising the meetings of the Advisory Board for Animal Production, issuing import permits and numerous other administrative activities. Its most important task, however, remains the administration of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act.

This Subdivision is no longer responsible for inspections under the Wine, Other Fermented Beverages and Spirits Act, No. 25 of 1957, since this responsibility was transferred to the Oenological and Viticultural Research Institute a few years ago. Similarly, the registration of nurseries was transferred to the Division of Plant and Seed Control during 1977.

This Subdivision, in co-operation with the Divisions of Plant and Seed Control and Veterinary Services, played an important part in the drafting of and negotiations on the agreements between the Department and Transkei, Bophuthatswana and Venda when they became independent.

The Division of Veterinary Services, Plant and Seed Control and Soil Protection handle the legislation specifically entrusted to them.

This introduction is not intended to give a complete picture of the regulatory services of the Department as a whole.

The administration of legislation - the most important function of the Divisions of Veterinary Services, Plant and Seed Control and Soil Protection - necessarily demands a great deal of time and attention.

The administration of legislation also plays a part in all the Regions and at the Oenological and Viticultural Research Institute, and the Soil and Irrigation Research Institute provides analytical and advisory services in connection with the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, No. 36 of 1947.

On the other hand, the benefits of the legislation to the country as a whole and to agriculture should be weighed against the cost and labour inputs. Although the original Soil Conservation Act of 1946 was less stringent than the 1969 Act, concern was expressed in 1946 that the Act, despite the unanimous support it was receiving, might in some respects be too drastic.

Today, however, Organised Agriculture supports the Department in cases where it institutes disciplinary action against persons who contravene the Act and do not respond to advice and cautions. The number of court cases is minimal compared with the number of cautions or prescriptions issued in cases where people are not prepared to co-operate voluntarily.

Similarly, the far-reaching Subdivision of Agricultural Land Act of 1970 has succeeded in preventing speculative and indiscriminate subdivision and in helping to regulate land use. The Division of Soil Protection is of the opinion that the measure has already created so positive an attitude that 75% of all current applications are now successful.

Furthermore the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967, has made a valuable contribution over the past 10 years to the improvement of standards of hygiene at abattoirs and to their management. It has made it possible to plan all new abattoirs on the basis of hygienic requirements and to improve numerous small abattoirs to meet specified minimum standards. The effect of legislation concerning agricultural pests and seed in regulating the nursery and seed industries is a further instance of what can be achieved through statutory measures.

In the wine industry the 1972 legislation on wines of origin has resulted in not only greater public awareness of wine as a natural product, but also the publicising of an interesting and exciting variety of distinctive table wines from the various production areas.

The Department's policy of submitting its legislation in draft form to the South African Agricultural Union and the interests or industries concerned has paid dividends over a long period. The fact that the Department exercises sound judgement, understanding and discretion in administering its legislation has also contributed to this success. The Department's general services for the agricultural industry run into a long list and only the most important will be mentioned here: financial assistance schemes under the Soil Conservation Act, soil, water and plant analyses, soil surveys for irrigation schemes, advisory services in connection with grain silos, boundary fences and roads, diagnostic services, tuberculosis and brucellosis schemes, the manufacture of vaccines, the training of dairy technologists and quality improvement services for dairy products. Progress has been made in most of these fields and it remains the aim of the Department to improve its services.

AGRICULTURAL RESEARCH

In introducing this extensive field it is possible to outline only the main points. Progress has been made with organisation, the provision of facilities and in the technical field.

ORGANISATION

The whole face of research in the Department of Agricultural Technical Services has been changed by the installation of a giant computer. In addition to the many other uses of the computer, the researcher now has computer facilities at his disposal for the processing of results.

A further logical step was the computerisation of the project system. This has made the effective overall co-ordination, planning and evaluation of the Department's research programme possible. There has been close co-operation with the South African Stud Book Association and this included the storing of all the Stud Book Association's data on the computer of the Department of Agricultural Technical Services.

The programme budgeting system was introduced, enabling the Department to apply systems analysis to its research and development programmes. The analysis of priorities is a very important component of this system, which also makes it possible to rationalise the funding of research.

The Soil and Irrigation Research Institute acted as the leader and co-ordinator of the research and development which resulted in the publication of "Soil Classification: A Binomial System for South Africa". This soil classification system was the foundation for many resource surveys in the Republic and has contributed a great deal to sound decision-making on the utilisation of resources.

This Institute has also made a great deal of progress in the mapping of areas (land types) where the soil pattern, landscape and macroclimate show a high degree of uniformity. Of the 70 1:250 000 sheets covering the Republic, 13 sheets have been or are being printed, the mapping for 23 sheets has been completed, and field work on a further 11 sheets has been completed.

The world of the future will be an energy-hungry world, and because field husbandry offers the best possibilities of producing energy-rich foods, main research centres have been chosen for the most important crops, namely for summer grain, small grain, oilseeds, protein seeds and potatoes. The aim is to develop these centres to their maximum capacity.

Progress has been made at Head Office with the installation of a computerised information system which will allow researchers easy access to international literature applicable to their research field.

A system of financing research at universities has been introduced in order to utilise the research potential of lecturers and post-graduate students for the benefit of agriculture in this country.

PROVISION OF FACILITIES

As regards the provision of facilities, buildings to the value of R4,6 million were erected during the past seven years. The following list gives

the most important buildings, their situation and cost:

Bloemfontein, Faculty of Agriculture: Various improvements	R 46 000
Onderstepoort: Alterations to kitchen	R 60 000
Rietondale: Rabbit house	R 20 000
Faculty of Agriculture, Pretoria	R 251 000
Stellenbosch: Helderfontein: Diagnostic centre	R 305 000
Pietermaritzburg: Allerton: Diagnostic centre	R 480 000
Potchefstroom: Offices for Assistant Director and diagnostic centre	R 379 720
Pretoria, Botanical Research Institute	
Brummeria Herbarium	R 805 344
Kempton Park: Jan Smuts Airport, Quarantine station	R 863 000
Onderstepoort: Conversion of hospital into laboratory	R 34 800
Roodeplaat: Extensions to building for wheat research	R 54 864
Stellenbosch: Fruit and Fruit Technology Research Institute	
Extensions to radio-isotope building	R 53 657
Irene: Animal and Dairy Science Research Institute: Administration building	R 1 050 000
Ermelo: Research building	R 344 700
Carnarvon: Office and laboratory building	R 82 600
Onderstepoort: Isolation stables for Virus Section	R 270 500
Onderstepoort: Workshop	R 272 000
Irene: Laying houses	R 117 700

A sophisticated laboratory for research on foot-and-mouth disease is being built at Onderstepoort at a cost of R8 million.

TECHNICAL FIELD

The Department has achieved considerable success in the field of research during the past seven years.

Good progress is still being made with breeding programmes for field crops. As regards maize, success was achieved with the release of breeding material that produces higher yields and is better adapted, particularly in respect of resistance to various diseases. Attempts to breed white high-lysine maize hybrids with the required properties were successful and the results were published internationally during 1978. Various new adapted wheat, oats and groundnut cultivars were released for cultivation and sunflower hybrids with a high oil content were bred.

More and more attention is being given to research on cultivation systems that require less energy, such as minimum and even zero tillage practices. This has proved particularly successful in Natal.

Good progress was made with fertilizer calibration for maize and sunflowers, and with the determination of the trace element requirements of sunflowers.

Considerable success has also been achieved in controlling diseases and pests. When southern leaf blight of maize *Helminthosporium maydis* race occurred in the lowveld area of Lydenburg during the 1973/74 season, intensive research on control measures prevented the disease from spreading.

Disease and pest forecasting and early warning services to enable producers to apply

control measures in time have recently been expanded. This has made a positive contribution to higher production.

The development of virus-free propagating material, the foundation seed potato scheme and the dry bean disease-free scheme are important results of research.

In the field of horticulture various new cultivars and selections of fruit, vegetables and flowers have been developed through breeding. Outstanding qualities were bred into new cultivars of table grapes, peaches, onions, beans, squashes, lachenalias, ornithogalums and proteas. New strawberry cultivars boosted strawberry production from about seven tons per ha to over 40 tons per ha.

Sweet potato yields were doubled by the use of new cultivars and good progress was made in breeding resistance into tomatoes against the most important diseases, namely canker, foot rot and spotted wilt.

A great deal of research has been carried out on apples and the results have significantly affected production, for instance by making the control of apple scab in the development of new rootstocks possible. A breakthrough was made in determining the cause of bitterpit and discoveries made in this respect aroused interest abroad.

The most important results produced by citrus research were the production of virus-free nucellar parent material, the integrated control of red scale and the control of greening. Soil-plant-water relations were determined with a view to obtaining the best fruit quality.

Research and development in the field of oenology and viticulture have placed us on a competitive footing with the leading countries in the world.

Important work on insects, mites, nematodes and rodents was carried out by the Plant Protection Research Institute. Their part in the destruction of plants of economic importance and their useful application as hyperparasites in the biological control of pests or as pollinators of plants were also investigated. Ultra-low volume spraying of locusts was developed, and has made a very important contribution to the control of this pest, which occurs periodically.

Research in connection with legume inoculants and nitrogen fixating in South African soils is acknowledged internationally and has helped considerably to boost agricultural production.

In the veterinary field progress with the study of diseases of economic importance continued, and discoveries were made which led to improved control. An example of this is the identification of haemadsorbent and non-haemadsorbent strains of the swine fever virus and the identification of the viruses responsible for gastro-enteritis in piglets.

Chlamydiosis was identified as the cause of epizootic abortion in virtually all farm animals and found to be one of the most important causes of foetal mortality and disease in new-born calves. An

effective vaccine against the condition was prepared.

Real progress was made with research on the physiochemical characteristics of bluetongue and African horsesickness viruses and a new classification of these viruses which was drawn up has received international recognition. Considerable progress was made with research on jaagsiekte among sheep.

Considerable progress was made with the biological control of midges *Simulium* sp. by the manipulation of the water level below the irrigation dams in the Vaal and Orange Rivers.

All aspects of parafilaria in cattle, which is a big economic problem, were researched. The life cycle of the parasite in cattle and the chemotherapy of the condition were determined. The vector fly was identified.

Good progress was made with country-wide campaigns for the extermination of tuberculosis and brucellosis in cattle herds, and very active diagnostic centres were established at strategic points.

Developments in the field of animal science included the introduction of performance testing schemes for the various branches of the livestock industry. These schemes compare favourably with the best in the world and are having a considerable influence on the genetic improvement of the national herd.

Agricultural engineering services to the farmer and the industry were expanded and greatly improved in all fields. The Division of Agricultural Engineering testing's programme for farm implements was recently expanded to include tractors. The progress the Department has made with research is due largely to the hard work and selfless dedication of the researchers.

FARMING AND AGRICULTURAL RESOURCE DEVELOPMENT AND THE ROLE OF REGIONAL ORGANISATIONS

The Regional organisations of the Department were established in 1953 with a view to meeting the needs of the various ecological regions in South Africa.

The intention was that the various ecological regions should be served direct by a central regional organisation which would combine all research, extension and agricultural education within each demarcated area into a single independent unit. Regional organisations comprise various scientific sections dealing with subjects such as animal breeding, field husbandry or chemistry and co-operating as a unit in studying plants and animals in relation to the environment, with the object of developing adapted farming systems.

Regional organisations were established for the following Regions:

Winter Rainfall Region
Karoo Region
Eastern Cape Region
Free State Region
Highveld Region
Transvaal Region
Natal Region

The organisational pattern that was followed from the outset has remained virtually unchanged, namely:

Administration
Research
Extension (including certain regulatory functions)
Training

AGRICULTURAL RESEARCH

Research has been an integral part of the function of the Regions since their establishment in 1953. In fact, a large research branch has always been characteristic of the Regional organisations. One such research branch, for instance, had 14 different sections right from its establishment.

As additional institutes were established and specialised research institutes and divisions became autonomous, the research sections at the Regions decreased. Lately research activities at the Regions centre around animal science, pasture science, field husbandry and soil science.

Some of the most outstanding research achievements of the Department took place in the Regions. Typical examples are the development of sheep and cattle breeds such as the Dormer, Dorper, Döhne-Merino, white-woolled mutton breed (being developed) and the Bonsmara.

Furthermore, field crop production has long been dependent on the cultivars bred in the Regions. Some of these cultivars are still being grown today.

AGRICULTURAL EXTENSION

A thorough investigation into the functioning of the Regional organisations was started in 1973. The result was a report entitled: "The Task of the Regional Organisations of the Department of Agricultural Technical Services" - June 1977.

The recommendations of the committee were accepted almost without exception by the Directorate, and some of them are already being applied successfully.

A few of these recommendations and the progress made in each case are mentioned briefly.

The recommendation with regard to the establishment of regulatory services sections at the Regional organisations was accepted. These sections will deal with all the financial aid schemes and will also be responsible for regulatory duties under the Soil Conservation Act, the Subdivision of Agricultural Land Act and the Weeds Act. The inspection branch of the Division of Soil Protection is being decentralised to the Regional organisations for this purpose.

As a result of a considerable increase in the work involved in applying the principle of optimum land use in the Regions, including resource classification and resource mapping, data gathering and processing and broad land use planning, a recommendation that a resource section be established at the Regional offices was also accepted. The staff division, in co-operation with the Regions, is in the process of establishing such a section.

As regards the formal training of extension officers at both the under-graduate and the post-graduate levels, guidelines for a training programme have been completed and universities can now be approached in this respect. Universities will be requested to consider the establishment of more than one chair of Agrarian Extension.

The recommendations in respect of in-service training for extension officers were accepted. An in-service training policy has been formulated and made available to agricultural Regions. The Subdirectorates and the Staff Office are working on the design of an in-service training system.

On the strength of the recommendation that more attention be given to research on extension science, the Secretary gave his approval for an officer to be made available at his present salary to the Extension Science Research Institute that is to be established at the University of Pretoria.

A number of recommendations on job satisfaction in the extension service were accepted. The most important result of this is that extension officers will in future serve within the professional field of extension science.

One of the results of recommendations on the recruitment of extension officers that were accepted was that the first study grants specifically for extension officers are now available.

TRAINING AT COLLEGES OF AGRICULTURE

Whereas the colleges of agriculture used to be autonomous institutions, each independently determining its own curriculum and general regulations regarding requirements for admission, examination requirements and disciplinary rules, there has been a thorough re-organisation over the past five years.

Important features of the new organisation included the following:

The curricula of all colleges of agriculture were critically evaluated on the basis of farming practices in the various service areas of the colleges, with adaptations where necessary.

Courses were standardised as far as was practicable, with the result that subjects such as basic animal production, basic plant production and agricultural organisation are now being presented at all colleges of agriculture.

Individual subjects presented at more than one college were standardised as far as possible.

The subject matter for each subject was written up and checked.

The regulations of all colleges of agriculture with regard to requirements for admission, examination requirements, disciplinary rules, etc., were standardised.

The following important organisational recommendations were accepted by the Department and have been or are being implemented:

A liaison committee for liaison between the colleges and the farming community has already been introduced at all colleges of agriculture.

A co-ordinating college committee consisting of the chief training officers and a member of the Subdirectorates has been introduced.

The upgrading of the post of Chief Training Officer to Assistant Director has been accepted.

The appointment of a group of lecturers, with a primary responsibility for training, on the establishment of the agricultural Regions was accepted.

A two-year diploma course with Std X as a requirement for admission is being retained.

To meet the need for training in agriculture, the facilities at colleges of agriculture are being extended so that it will be possible to double student numbers within 10 years.

Further developments with regard to training at colleges of agriculture include the following:

(i) The Public Service Commission has been requested to have the curricula evaluated by the HSRC with a view to having the Agricultural Diploma recognised as equivalent to a M+2 (Matric plus two years of college training). The support of the Department of National Education has been obtained in this respect.

(ii) A new college of agriculture will be established at Nelspruit in the early eighties.

It is no exaggeration to say that training at colleges of agriculture has never been better than at present.

ACHIEVEMENTS AND GROWTH IN THE REGIONS

Specific achievements by various Regions during the past few years with regard to the execution of the policy of optimum land use should be mentioned. For instance, work was done on resource classification and mapping programmes, the demarcation of homogeneous farming areas, the drawing up of standards and overall land use planning in development areas.

Important breakthroughs were made by the Regions and the Divisions of Soil Protection and Agricultural Engineering in creating positive attitudes among farmers towards the conservation of agricultural resources during the past few years. Run-off control plans, of a nature and on a scale unprecedented in the conservation history of the country, are being applied and are without doubt proof of the success achieved in this field.

During the past few years exceptional inputs went into establishing co-ordinating mechanisms

within the functional field of the Regions. The most important inputs are the following:

- (i) The creation and filling of three posts in the Subdirectorates, namely those for irrigation planning and development, resource development, and extension and training.
- (ii) The establishment of an umbrella Directorate Committee for Agricultural Regional Development and the further establishment of ancillary groups working on resource classification and the drawing up of standards.
- (iii) The establishment of directorate committees for irrigation planning and development for the Winter Rainfall Region, the Central Region and Trans-Natal, with ancillary teams.

Various expansion programmes in respect of facilities for the Regions were started during the past eight years and are now being rounded off. The following are the most important of these programmes.

- (i) A R1,5 million building programme at the Glen College of Agriculture, which has been completed.
- (ii) A R4 million building programme, which is being carried out at the Cedara College of Agriculture.

- (iii) A R5,6 million building programme, which was started at the Elsenburg College of Agriculture in 1979.
- (iv) A R700 000 building programme at the Potchefstroom College of Agriculture, the tender date for which is August 1980.
- (v) A R1 million building programme, which is at present being carried out at the Grootfontein College of Agriculture.
- (vi) A R1 million building programme, which, it is hoped, will be started at the Döhne Research Station this year.

This Station has now become the headquarters of the Eastern Cape Region.

The staff of the Department has the infrastructure, organisation and knowledge necessary to do justice to the diversified yet integrated services the agricultural industry will require in future. Larger and more intensive agricultural inputs will be needed to enable the farmers of South Africa to make increasingly efficient use of the available agricultural resources and so ensure steadily increasing production.

II. Plant Production Improvement

FIELD HUSBANDRY RESEARCH

SUMMER CEREALS

MAIZE

Breeding

The past season was notable for the large-scale evaluation of a wide range of breeding material for various diseases.

Evaluation for northern leaf blight *Helminthosporium turcicum* was extremely successful and it was possible to identify several highly resistant sources. New methods of infection and evaluation for boil smut, anthracnose and streak were tested and appear to have the potential to produce outstanding results in future.

For the first time in a long while completely new pure strains were again developed at Potchefstroom after four generations of inbreeding. Some of these strains will be used in further combination trials during the coming season to determine their usefulness for commercial application.

A wide range of breeding material (both pure strains and populations) was obtained from the



Potato and maize trials at the Cedara College of Agriculture

USA and Mexico and multiplied. Next season this material will be extensively tested for diseases and agronomic adaptability and should make a big contribution, especially with regard to new sources of resistance.

The sweet corn programme was successful and extensive co-operative plantings were made in co-operation with the local canning industry. Promising single cross hybrids were again identified. New South African pure strains will be tested in combination with well-known strains from the USA for the first time during the coming season.

Despite a very dry December and destructive windstorms at the Ukulinga Research Station in February, the season was generally favourable for high maize yields in Natal and the high potential areas of the country. Forty-four small-plot yield trials were carried out in various parts of the maize growing areas of the country.

At Tabamphlope Research Station, experiments have indicated record yield levels of approximately 14 tons/ha (155 bags of 90 kg/ha) with a commercial hybrid and experimental yellow single crosses. These exceptionally high yields were attained with a plant stand of 60 000 per ha, on soils that had been purposely fertilised and limed for high yields and the elimination of the characteristic local aluminium toxicity.

Yields of 14 tons/ha were also obtained in observational test plots at Hillcrest (in co-operation with Sensako) with the high-yielding single cross type F2834T X M37W. Further, in replicated yield trials with similar yellow material, this outstanding single cross was the highest yielder at Cedara, Delmas and Potchefstroom, where top yields in excess of 10 tons/ha (100 q/ha) are expected in each case. All these yields were obtained with hybrids that produce kernels of the normal size.

High lysine

Yields of the highly successful NO61 series white opaque-2 (high lysine) hybrids (also of the F2834T X M37W type) have similarly been estimated at over 10 tons/ha in experiments at Kokstad, Cedara, Highflats, Greytown, Dundee, Potchefstroom and Delmas, the highest yields having been obtained at Kokstad and Delmas. It is notable that without exception these NO61 series high lysine hybrids outyielded the newly released white Rhodesian opaque-2 hybrid R61 (previously known as 75-OP-13 or 75-OP-22) at all the reported nine co-operative test sites. This confirms results given in the previous two years' reports. It should be remembered that no opaque-2 hybrids have yet been released in South Africa.

Sufficient seed for 400 ha of the outstanding white opaque-2 hybrids NO6124, NO6122 and NO6144 was distributed to about 50 contract producers, farmers, plant breeders, feed manufacturers and agronomists in a comprehensive evaluation programme. Stands viewed throughout the A marketing area of South Africa were highly

promising and in many cases yields are expected to exceed 10 tons/ha. Preliminary reports indicate that yields of approximately 9 tons/ha were realised at Kempton Park.

Photoperiod insensitivity

Significant progress can be reported with (1) the conversion of useful tropical maize germ plasm to photoperiod insensitivity and (2) the development of three breeding populations - containing variable amounts of tropical germ plasm - that are insensitive to the photoperiod.

The advances made in the photoperiod work in Natal are of great interest in that there is now an opportunity to incorporate valuable new germ plasm into the genetically narrow local breeding material. Further, considerable interest in this work has been shown by breeding programmes in Mexico and the USA, which has resulted in the exchange of information and the acquisition of potentially valuable new breeding material.

Cultivar evaluation

The cultivar evaluation programme has shown the following progress:

Evaluation of maize cultivars

During the past year 66 cultivars were tested at 67 localities in the production area. Quality analyses for protein and milling quality were carried out on 49 cultivars.

Evaluation of grain sorghum cultivars

During the past season 30 cultivars were tested at 26 localities and their brewing qualities were evaluated.

Evaluation of buckwheat cultivars

Buckwheat research was transferred to the Summer Grain Centre during the year under review and 21 cultivars were tested at two localities within the buckwheat production area and at Potchefstroom. Only nine of these cultivars showed promise with regard to yield and quality and cultivar evaluation will in future be concentrated on these nine cultivars.

Evaluation of millet cultivars

A millet research programme aimed at grain production was launched by the Summer Grain Centre. Over 200 babala types were collected from South Africa and various parts of the world and the seed will be multiplied for cultivar evaluation. Types of which sufficient seed is already available will be tested during the coming growing season to determine their suitability for use as standards in future evaluation programmes.

Characterisation of maize cultivars

The effect of the planting date on the behaviour pattern of 25 commercially viable maize cultivars was investigated. Of the characteristics that are of biological value, the following are affected:

- Growing season from planting to flowering to physiological maturity
- Drying rate
- Kernel growth and duration
- Grain: straw ratio
- Grain production
- Yield components, number of ears, ear size, number of kernels per ear, kernel size, kernel mass and kernel quality

Characterisation of grain sorghum cultivars

A characterisation trial was carried out at Potchefstroom with 10 popular grain sorghum cultivars.

The effect of the planting date and espacement on the growth and development of the plants was studied in this trial and observations were made on the following: development of the plants from planting to flowering, kernel development up to physiological maturity, kernel drying rate, tiller development, grain:straw ratio and grain production.

Soil cultivation

Three trials were carried out on a light sandy soil in the Viljoenskroon area with the object of investigating the problems of wind erosion and compaction. Two trials were carried out on a Viljoenskroon series with about 3% clay and one on a Bleeksand series with a clay content of about 6% in the topsoil.

Four tillage systems, namely conventional ploughing, trench ploughing, subsoiling along the rows only and full subsoiling, were tested on the Viljoenskroon series and repeated in the same form on the Bleeksand series. A further trial with six different subsoiling treatments was carried out on the Viljoenskroon series. Observations of the root development, bulk density and soil strength were carried out at every 10 cm, to a depth of 60 cm.

The various treatments did not produce significant differences in yield in any of the trials. This is probably due largely to the exceptionally high rainfall in the area during the past season.

Plant pathology

Survey of diseases

A survey on the incidence and distribution of maize diseases in the chief cultivation areas of the Republic is being undertaken. This programme which is being carried out in co-operation with the Department of Botany of the Potchefstroomse Universiteit vir CHO, is progressing well and the microbiological identification of the organisms found is being undertaken at present.

Valuable information on the distribution of known diseases will be obtained and diseases not known to occur as yet will be traced. This programme is expected to contribute a great deal to our knowledge of maize diseases.

Leaf spot diseases

Commercial and new cultivars were successfully evaluated for susceptibility and resistance to northern leaf blight *Helminthosporium turcicum*. The results show that the new cultivars are more resistant than the commercially available cultivars, which indicates that the overall breeding programme for resistance to this disease has made considerable progress.

Head smut

The evaluation of cultivars for susceptibility or resistance was undertaken and the results of this programme are available.

Grain sorghum diseases

Progress was made with the study of grain sorghum diseases. Fourteen organisms that cause diseases of grain sorghum were isolated.

The evaluation of cultivars for susceptibility or resistance to ergot *Sphacelia sorghi* was undertaken and all the cultivars proved to be susceptible.

Entomology

Maize stalk borer

The further testing of systemic insecticides that are applied at planting time in the planting furrow produced two preparations in addition to the one already registered, namely carbofuran. These preparations promise to be valuable in stalk borer control. In trials with sprays a relatively new group of preparations, known as the synthetic pyrethroids, provided effective control of the stalk borer at very low dosages. Some of these preparations were also capable, when administered before tassel emergence, of reducing damage to ears caused by late infestations to a greater extent than the preparations registered at present.

Research on the determination of economic threshold values for stalk borer control indicates that although the direct damage to ears increases in proportion to the time after emergence at which the eggs are laid, the maximum damage to ears takes place when oviposition occurs at six weeks after emergence. Research also indicates that the length of the growing season of maize hybrids has an effect on the amount of damage the maize stalk borer causes and that hybrids with a long growing season suffer most severely. Row width may also affect the degree of damage done, since a higher percentage of larvae survive the season at row widths of 0,9 m than with wider row espacements, where the leaves of plants in adjacent rows do not touch.

Leaf hopper vectors of streak

A bulk breeding method for the maize leaf hopper *Cicadulina mbila* was developed in order to make it possible to infect maize breeding material artificially with streak. A technique for infecting the material on a field scale was tested and found successful. The same method was used to confirm the hypothesis that maize plants infected with streak six weeks after emergence do not show economically significant yield losses.

Grain sorghum pests

Trials with the systemic preparation carbofuran showed that cases of phytotoxic damage to grain sorghum caused by the preparation may possibly be ascribed to excessive soil moistures. Where it was applied as a side treatment three weeks after emergence, carbofuran provided significantly better control of sorghum pests than in the treatments where it was applied to the seed at planting time. In some cases it resulted in an increase in the yield of up to 150 per cent.

Several sprays were identified that are capable of providing effective control of the stalk borer species at dosages sufficiently low to cause no phytotoxic damage.

Nematodes

Further trials undertaken to determine the effect of nematode infestation on summer grain production showed that nematodes are a limiting factor in the Vaalharts irrigation area, as in other areas. Soil fumigation increased the yield from 6,8 to 10,3 tons per ha. Both maize and grain sorghum responded favourably to fumigation. At Viljoenskroon the combined control of nematodes, stalk borers and fungi boosted the yield by from 2,2 to 8,3 tons per ha, and the treatments were able to produce a significant improvement in the number of root lesions, and in the stem thicknesses and plant heights. In trials at various fertilising levels at Cedara, it was shown that the utilisation of nitrogen is particularly badly affected by nematode infestation. Researchers are now concentrating on finding an economic solution to the nematode problem.

Plant feeding

The crop response of maize to nitrogen, phosphorus and potassium fertilising on a variety of soils in the Eastern Transvaal Highveld has shown for the sixth successive year that nitrogen is the element chiefly responsible for raising yields. The response to phosphorus is dubious (depending on the soil's P values and pH) and the application of potassium has not so far made any real difference to yields.

The application of phosphorus in the form of raw phosphate and in the water-soluble form to a soil poor in phosphorus produced a very favourable response in respect of grain yield for the second successive season. During the past season, unlike

the previous season, the raw phosphate produced notably better results than the water-soluble phosphorus, judging by the effect on grain yield.

The application of various quantities of potassium to a sandy loam soil showed no significant difference in the yield for the second successive year, not even when large amounts of potassium were applied.

The effect of the application of zinc on maize yields was also investigated, but no response was found.

WINTER CEREALS

Breeding work on small grain in South Africa has been consolidated into one programme, centered at Bethlehem. The programme provides for the improvement of winter wheat, intermediate wheat and dryland and irrigated wheat. The main breeding programmes are being backed up by auxiliary services provided by specialised sections such as international nurseries and the sections dealing with plant pathology, quality evaluation, biometrics and computer science.

The main criterion for selection in respect of all wheat strains remains resistance to stem rust, and the breeding strategy and methods of evaluation are still geared to overcoming the problem of stem rust - a big factor in limiting yields. In an attempt to obtain additional genes for resistance, all 11 169 wheat strains imported from 22 nurseries throughout the world through the international nursery programme were accurately analysed in respect of this pathogen.

From the 1 000 strains that showed resistance, the following Sr genes appear to be conducive to resistance to a greater or lesser extent: Sr 5, 6, 8, 11, 12, 16, SrTt, SrTt 2 Tc and Hope. The best resistance was found in SrTt and SrTt 2, and on the basis of superior performance in long-term adaptation trials two cultivars with this resistance were finally released and two strains nominated for release to the industry as new cultivars.

These cultivars and strains were:

1. BT 37 Flameks/ x 4 (Minturki/ *T. timopheevi*) (Dipka)
2. BT 38 Flameks/ x 4 (Minturki/ *T. timopheevi*) (Gou-ritz)
3. XMS 52 Flameks/ x 4 (Minturki/ *T. timopheevi*)
4. Zaragoza 75 Mengavi/8156 (Minturki/ *T. timopheevi*)

The first three strains were bred locally and Zaragoza 75 was imported into South Africa from the CIMMYT programme, through the international nursery programme. The first three strains are dryland spring wheats, and the last one is an irrigated spring wheat.

Studies on *Septoria* infection in local material have cast doubt on the present method of evaluation. Data collected indicate that crop losses

as a result of natural infection can amount to 15,43 %, and that this figure can be increased to 21,22 % under conditions of artificial infection. However, the present system of evaluating disease does not reflect crop losses of this magnitude. A criterion such as the 1 000 grain mass would give a better indication of the degree of infection.

The research into root diseases being conducted on the Springbok Flats in co-operation with the University of Pretoria is proceeding and considerable progress is being made with the identification of the pathogen(s).

Quality analyses have revealed that the locally developed rust-resistant winter wheat strains make a particularly poor showing, judged on the basis of mixogram curves and protein content. Only 11 % of all the strains tested qualified for selection on the basis of the Betta standard. In order to improve the position, an intensive crossing programme is being undertaken with strains from the "High protein - High lysine" nursery in Nebraska. Data from Nebraska have shown that strains from the crossing Atlas/Nap Hal produced protein contents of up to 23 % under local conditions, as against an average of 11,5 % from the locally developed material.

The number of strains handled at various stages of the breeding programme is still increasing, which is stimulating the development of suitable biometric and other methods of testing in order to handle the volume of material. During the year under review the following numbers of strains were evaluated in the course of all the test programmes:

New crossing combinations	: 2 013
Segregating strains	: 57 167
Preliminary evaluation trials	: 2 971
Final evaluation trials	: 720

If this volume of material is to be rapidly and accurately evaluated, suitable biometric and computer auxiliary services will be required. Most of the programmes are already available and those that are missing are being systematically developed and added. The mechanisation of handling operations is also progressing satisfactorily.

Durum and triticale research undertaken in co-operation with the University of Stellenbosch is progressing favourably. A new durum cultivar, Nordum, which was received from North Dakota in the USA, was made available to the industry.

Contact with overseas states was established through the SARWEIN programme during the year under review; ties were formed with Lesotho, Swaziland, Botswana, Rhodesia and Mozambique and personal visits were received from officers from the USA, Mexico, Ecuador, Peru and Brazil. Overseas visitors included Dr Glenn Anderson, the Deputy Director of the CIMMYT programme.

During the year under review 19 elite wheat trials were carried out in the Free State under dryland conditions and six similar trials were conducted on the Springbok Flats. Eleven elite trials were carried out in the winter rainfall area

and 36 dryland cultivar trials throughout the entire summer rainfall area. Thirty-nine wheat trials were carried out under irrigation. In the winter rainfall area cultivar trials were carried out at 25 localities, with 24 entries at each locality, and newly released cultivars performed best.

The results of the elite trials were highly satisfactory and an intermediate strain, XMS 52, was provisionally released with 10 850 kg of foundation seed. The strain is well suited to planting during late winter/early spring in the Eastern Free State. The grain yield of the strain is good, and it is rust-resistant, with a good baking quality. The irrigated strain Zaragoza was provisionally released at the same time. This strain has an exceptionally high yield potential under irrigation. It has good resistance to disease but the baking quality is average. The results of the cultivar trials prompted far more specific recommendations. They also made the critical evaluation of strains that are no longer making much of a contribution possible. The results of these trials contributed to the drawing up of an effective national cultivar list for small grain and only varieties of which seed is available in the industry are recommended at present. Since wheat is planted virtually throughout the year the correct planting time for a specific cultivar is of the greatest practical importance.

These trials also led to the two strains BT 37 and BT 38 being finally released to the industry with 19 530 and 15 750 kg of foundation seed respectively. The two strains BT 37 and BT 38 were released under the names of Dipka and Gouritz, respectively. The cultivar Dipka is particularly well adapted in the Rûens and South-Western Districts, and Gouritz does well as a spring cultivar in the Eastern Free State. These two cultivars are expected to be well adapted in the perennial rainfall area. The cultivar trials also made it easier to place the supply of foundation seed of Departmental cultivars on a sound footing and 231 tons of foundation seed was supplied to Sensako for further multiplication and distribution to the industry.

At present there is a considerable need for suitable oats cultivars to be grown as pasture and/or rotation crops. Evaluation trials were carried out at Bethlehem, Sandvet, Vaalharts and Riet River and a few promising strains were identified. Elite trials were also planted at various localities in the Swartland and Rûens.

The Rûens has always been the centre for barley production but experimental work with short-straw barley varieties was also started at Vaalharts recently. The results were very promising and the first short-straw irrigated barley, Diamant, which comes from Rhodesia, has been provisionally released. Seed is being multiplied rapidly this year, so that the results can be applied. The elite barley trial was planted at eight localities in the Winter Rainfall Region. New material appears promising. A seeding density trial was carried out at Tygerhoek.

In the past there have been major problems with the spraying of weeds with hormone-type weedkillers. Grain yield losses can be cut down by using growing point development as the criterion for spraying. Over the past year a series of trials were carried out under controlled and natural conditions and contrary to expectation some contact preparations caused fairly big yield losses. The biggest weed problem is still wild oats, which is gaining ground yearly owing to unfavourable conditions for spraying in the summer rainfall area, ineffective preparations and the excessively high prices of weedkillers.

Owing to the lack of suitable fertilising standards, producers are often misinformed and in order to find the answers to certain questions a fertilising programme in terms of NPK was started; yield, yield components and biological yield were measured in succession. The last-mentioned components indicate that the optimum nitrogen level for winter wheat is between 6 and 10 kg of N/ha, and that for intermediate wheat between 18 and 24 kg of N per ha. The winter planting showed a favourable response on 15 kg of P per ha, and the highest grain yield was obtained from an intermediate planting with a lower level of phosphate fertilising. The NPK fertilising appeared to have very little effect on the Springbok Flats; nevertheless it appears that 25 kg of N and 16 kg of P per ha produced the highest yield. The response to potassium was inconclusive. Under irrigation the somewhat lower levels of nitrogen than are generally recommended produced the best results and the standard recommendations will therefore have to be revised.

In the winter rainfall area trials were laid out with wheat, oats and barley in order to improve phosphorus and potassium fertilising and further refine the calibration of methods of soil analysis. Good results have already been obtained.

Trials with cultural practices in the Winter Rainfall Region again revealed considerable differences in yield between the treatments, but more work appears to be necessary before definite recommendations can be made.

Seeding time, seeding density and fertilising trials have revealed improved or new information.

Rotational cropping and farming systems underwent further testing at Langgewens. Considerable differences in grain and animal yields have already been found between treatments, but further research and interpretation of the data are necessary.

Aphid surveys revealed five active species - which is less than last season. Chemical control has never been necessary.

OILSEEDS AND HIGH PROTEIN SEEDS

GROUNDNUTS

A great deal of work was done on the control of leaf diseases in groundnuts. Leaf spot

control trials at the Vaalharts Agricultural Research Station once again yielded excellent results. Dryland plantings produced good yields, but the quality was poor as a result of adverse conditions in the stacks. This situation was caused mainly by pre-harvest defoliation of the plants as a result of leaf spot diseases coupled with the loose stacks. Producers at the Vaalharts Irrigation Scheme are experiencing considerable difficulties with pod rots. It appears from literature on the subject that this is an extremely complex situation in which a variety of soil fungi, nematodes and soil conditions play a part. The disease has assumed such proportions that an intensive research programme is planned for the coming season.

A number of groundnut fertilising trials produced good results. Liming of acid soil (pH measured in KC1, 3,8) to an acceptable level (pH 4,4 in KC1) resulted in an increase of 75 per cent in kernel yields - from 2 447 kg/ha to 3 840 kg/ha. The national groundnut cultivar evaluation programme was continued; cultivar trials were held in all the most important production regions. The cultivar Sellie, which was developed by the Department, again performed very well, particularly in respect of kernel size and quality. Groundnut seed obtained from all the most important production regions was evaluated in a yield trial. The results indicate a remarkable improvement in the genetic quality of the seed used. An obvious problem at this stage is the poor performance in respect of large-kernel yields of the Natal Common types, which are still widely used in opposition to Selly.

SUNFLOWERS

The keen interest in sunflower production continued and there was an increasing demand for information in connection with the performance of cultivars and advice in respect of cultural practices. Production increased from an estimated 255 000 tons in 1975/76 to 476 000 tons in 1976/77 and an estimated 550 000 tons in 1977/78. This increase in production may be attributed to both an increase in the area planted and improved production techniques. The average yield for the country was 1,2 tons/ha, which compares favourably with that of other sunflower producing countries.

Sunflower cultivars were evaluated at 36 localities for the Departmental evaluation programme, which included all commercial cultivars as well as new hybrids. The trial programme renders an extremely valuable service, not only in respect of the screening of new cultivars but also in the determination of sunflower yield norms for different situations. In spite of a relatively unfavourable season, more than half the trials produced an average yield of more than 2,5 t/ha, and a number of yields were over 4,0 t/ha. Hybrids again performed very well, and as a result there is a great demand from producers for hybrid seed. The indications are that in the near future the

greater part of the local sunflower plantings will consist of hybrids.

A number of sunflower fertiliser trials at the Dundee Research Station attracted wide interest. In a study of the boron needs of sunflower cultivars it was found that cultivars vary considerably in respect of their ability to take up boron from the soil. The seed yield from a cultivar described as inefficient in taking up boron was increased by 116 per cent after the application of boron.

DRY BEANS

The release of promising new cultivars from breeding programmes has increased the need for well-organised cultivar trials in the most important production regions. The production of disease-free seed has made excellent progress. A summer planting of disease-free seed in the Winter Rainfall Region was very successful and the harvested seed was found to be free of disease.

A further generation was planted at the Burgershall Experimental Farm in the Eastern Transvaal Lowveld for further multiplication. Multiplication is so fast that it will probably be possible to make disease-free seed available to producers in the near future.

SOYA-BEANS

The particularly keen interest in soya-bean production has resulted in a heavy demand for seed that is genetically pure and of a high quality. Seed of the available commercial cultivars shows alarming genetic impurities. Cultivar trials were carried out at the Potchefstroom Agricultural Research Institute and the Loskop Experimental Farm at Groblersdal. The new cultivar Oribo performed well and is particularly suitable from the point of view of plant type. It is a cultivar with a determinate growth habit which is less prone to lodging than the commercial cultivars which are commonly available. Yields as high as 3,72 tons of seed per hectare were obtained under irrigation.

POTATOES

Breeding and selection

The cultivar Baku, which was made available to seed potato growers last year for further evaluation and multiplication, did very well with regard to both yield and resistance to several important diseases. This cultivar makes a very good industrial potato, and a table potato of satisfactory quality. There is so much interest in the cultivar that about 90 ha will be planted to seed potatoes this year.

Seed potatoes of the cultivar Astrid are now being made available to growers for multiplication and large-scale evaluation. This cultivar performed very well in the national cultivar trials during the past five years. Astrid has a light yellow flesh, a good quality for industrial purposes, and is more

resistant to most important diseases than the standard cultivars.

In the course of the national cultivar and breeding strain evaluation programme, strains from the Departmental breeding programme that perform better than the standard cultivars have been found in several areas. For instance, some strains produced almost double the yield of BP1, the standard cultivar, in the Winter Rainfall Region during the test period of four years. These strains are being multiplied at present in order to make seed potatoes available to seed potato producers.

Keeping quality

Several factors that affect the keeping quality of potatoes were investigated. The aim was to improve the poor keeping quality during the hot summer months. The keeping quality of potatoes from the Northern Transvaal and Highveld was investigated on the Pretoria and Cape Town market at various marketing periods. The effects of fast and slow rail transport and of various thiabendazole treatments on the keeping quality were also investigated. The incidence of rot was very significantly lower in Highveld potatoes, on the Cape Town market and during the December to January marketing period. However, the market grading was the same for Highveld and Northern Transvaal potatoes. It was better on the Pretoria market. Thiabendazole treatment had little effect on the keeping quality. The results clearly show that the keeping quality of potatoes differs radically for different production areas, markets and times of the year. It was also clear that slow rail transport should be avoided and that the thiabendazole treatments require further research to make them more effective.

Diseases

Brown scurf

In the past this disease occurred only on soils with a high pH, but it has now been found that the disease is starting to cause serious problems on sour soils as well. Acid-tolerant strains of the pathogenic organism appear to have developed and to have started spreading through the country.

It has been found that treatment of seed potatoes with mancozeb limits the spread of the disease. It has been proved that the disease is spread by seed potatoes that show no visible symptoms of scurf on the tubers but that are nevertheless infected. If the soil is already infected, there is no point in treating seed potatoes against the disease before planting. The most promising soil treatment is the use of quintozene at 50 kg 75 per cent wettable powder per ha, but further testing is required and the treatment techniques will have to be refined.

Late blight

The late blight forecasting services in Natal and on the Transvaal Highveld again rendered a

useful service to potato producers during the past season. Farmers are using the services to an increasing extent, and considerable savings on spraying costs are being effected.

Black scurf

The results of local research show that at present there is only one promising non-mercuric preparation for the control of *Rhizoctonia* in seed potatoes. Further evaluation is being planned for the following season. With regard to soil treatment, the preparation PCNB, applied at a concentration of 50 kg per ha, seems very promising. Effectiveness is reduced at lower concentrations, but satisfactory control is still obtained. The most important requirement when using PCNB is thorough mixing of the preparation with the soil. Interestingly enough, data from the trials show that the type of nitrogen fertilising has a marked effect on the incidence of black scurf. When nitrogen is applied in the form of ammonium sulphate, there was considerably less infection than when limestone ammonium nitrate was applied.

Insect pests

Aphids and viruses

In order to further research on the migratory habits of the green peach aphid on the Transvaal Highveld, the number of localities where yellow traps were placed was increased from eight to fourteen. These surveys took place on a weekly basis from August 1977 to February 1978.

Information obtained on the Transvaal Highveld during the past two years indicates that the aphids in this production area migrate actively during September and October - the main migration - and then again from December to February.

The biggest single problem of the potato producer in the Winter Rainfall Region remains the control of viruses in potato plantings established for seed potato production. The problem is complicated by the fact that in this Region seed potatoes are produced in areas with divergent climatic conditions, during various times of the year, and in proximity to the fresh market production area.

The continuous monitoring of virus vectors in all the seed potato production areas in the Winter Rainfall Region is giving researchers a clearer picture of the problems characteristic of each specific area.

Research to date has emphasised the fact that the success of virus control in seed potato production is tied up with the successful application of the principle, "Exploit the vector-free periods and/or periods of low virus vector activity".

The foundation seed potato breeding material from the Sabie/Lydenburg scheme is still being intensively monitored for the most important virus diseases, but again no virus diseases could be found.

At Roodeplaat one of the promising new breeding strains, viz H11, was purified of potato virus S by means of heat therapy and tissue culture.

During the year under review an antiserum against potato virus X was prepared at Roodeplaat, and the preparation of an antiserum against potato virus S was started.

Cutworms

Cutworm damage was not as serious a problem as during the previous season in the same localities, and it would appear that these insects cause sporadic damage. This insect pest is nevertheless still receiving attention.

Black maize beetles

In the past tuber damage by this insect was confined to the Transvaal Highveld, but during the past season it also occurred over a wide area in the Eastern Free State. The black maize beetle is an increasing problem and is receiving a lot of attention in surveys and research programmes. No practical method of controlling this insect has been found so far.

Snout beetles

The snout beetle which is responsible for damage to potato tubers in the Eastern Free State has been identified as belonging to the genus *Scibius*. Species identification is taking place overseas at present. Methods of controlling this troublesome insect are being investigated.

Cultivation and fertilising

The results of trials at and around Ermelo show that slightly higher levels of P fertilising can now be recommended than the levels given in the potato pamphlet (F3/1975). Owing to the high K content of Northern Transvaal soils around Vivo, no yield response was obtained with K fertilising and no K fertilising is therefore recommended here. For the rest, responses to fertiliser were consistent with the recommendations contained in the pamphlet.

With regard to loss of mass, quality and keeping quality, NPK fertilising again had no notable effect. Soft rot was slight and occurred only where the tubers had been mechanically damaged. This underlines the necessity for strict sorting for mechanical damage in order to ensure good quality and keeping quality.

Fertilising studies in Natal show that on the whole farmers apply more K fertiliser than is really necessary. The fertilising trials at Bethlehem and Clocolan have been successfully wound up. Although the results of these fertilising trials have not been completely processed, it appears that there is good potential for potato growing in this area if farmers can be given adequate information on new cultivars and general basic cultural practices.

The results of a project on potato cultivation at Glen showed that both the yield and the number

of tubers underwent a linear increase when the levels of nitrogen fertilising were increased from 0 to 200 kg of N per ha. With regard to potassium fertilising, it was found that the case of all levels (150, 300, 450 kg of K/ha) the application of K reduced both the yield and the number of tubers harvested in comparison with the control treatment. Good rains throughout the season cancelled out the effect of the various irrigation treatments.

Research at Cedara on the effect of soil moisture stress on various potato cultivars showed that moisture stress for three weeks during tuber initiation reduced the yield of BP1 by 14 %, that of Cedara by 24 % and that of the cultivar Koos Smit by 30 %. Moisture stress also resulted in a considerable reduction in the quality of the potatoes, particularly in the case of BP1.

Weed control

All three of the chemical herbicides applied prior to emergence, namely metribuzin, linuron and paraquat, produced excellent control of weeds in both the winter and the spring potato plantings in the Winter Rainfall Region. The herbicides had no visibly harmful effect on any of the three cultivars grown, viz BP1, Vanderplank or Up-to-Date, or on the beans, maize and lettuce (summer) and cabbage (winter) that followed the potatoes directly on the same soil. Like the winter plantings, the spring planting showed no difference in total production between the treatments where chemical weed control was applied and those where mechanical control was practised. However, all these treatments produced for higher yields than the control when no weed control was applied.

Since the treatments for which chemical control measures were used were not earthed up, there was more damage owing to sunburn and insects than where mechanical weed control was applied and the plants were earthed up. The marketable yield from the latter treatments was therefore 36,1 metric tons per ha, as against 28,0, 25,8 and 23,8 metric tons per ha from the treatments where paraquat, linuron and metribuzin, respectively, were used.

Although the herbicides control weeds effectively, the potatoes should still be earthed up to control sunburn and insect damage.

COTTON

Introduction

Estimates for the 1977/78 season indicate that the total crop will amount to about 241 000 bales of lint of 200 kg each. There is no prospect of exporting lint; an extra 50 000 bales will have to be imported. South Africa's consumption of cotton lint for 1978 is estimated at 260 000 bales.

Estimates for the first quarter of this year indicate that 51 per cent of the total crop will consist of Cape Acala and Acala 1517-70 types of lint, 21 per cent of Deltapine plantings and 16 per cent of Acala SJ-1 plantings. The remainder will be

contributed by Albar, Albacala, Coker, CS2 and Alma.

Since the demand for denims has dropped sharply, purchases of spinners at present consist chiefly of the finer and longer Acala types of lint for use in blends with synthetic fibres.

Breeding programme

Excellent progress was made in the Loskop area with the breeding of a possible replacement for Deltapine. Selections carried out simultaneously at Upington and the Loskop Research Station within a AET x G21/17/904 crossing produced a number of very promising breeding strains which it will be possible to evaluate on a larger scale next season.

Commercial spinning tests by the SAWTRI are again being carried out on the Upington-bred strain SJ-141 and the Loskop-bred Alma to make quite certain that the lint of these Departmental breeding strains is acceptable and could find a place in the South African cotton lint market. Reports from commercial spinners, to whom samples were supplied, will also be taken into account when deciding on the registration of the two promising breeding strains.

Isogenic okra-leaved strains of Deltapine and SJ-1 will be evaluated at various localities during the coming season. The results obtained during the past season indicate that the okra-leaved strains are earlier and produce higher yields than commercially grown Deltapine and SJ-1 with normal leaves.

Conditions at the Vaalharts Research Station during the past season were favourable for selection for tolerance of *Xanthomonas* and *Alternaria*, and material from both the Upington and Loskop breeding programmes was evaluated at Vaalharts for tolerance of the two diseases. Very good progress is being made with breeding for tolerance of these two diseases.

Defoliation

An evaluation of defoliants showed that the cover of the chemical used that can be obtained on the leaf surface and the concentration of the preparation are very important factors in the successful defoliation of cotton. The low nocturnal temperatures experienced in May produce poor defoliation. Good defoliation was obtained under these cool conditions when thiophosphate was applied at a concentration of three litres of active ingredient per ha. Better defoliation was obtained by spraying higher volumes per ha - at least 300 litres per ha was required. Concentrations of 6 to 10 mℓ of thiophosphate per litre of water are required. It takes at least 14 days before acceptable defoliation is obtained with thiophosphate.

Magnesium chlorate ensured good to outstanding defoliation at a dosage of 5 to 15 litres of active ingredient per ha. Defoliation was good with low concentrations and high volumes per ha or high concentrations and low volumes per ha. Concentrations of 14 mℓ or more of magnesium chlorate per litre of water, together with a good

leaf cover, kill the leaves and leaf stalks and a poor leaf fall is obtained.

Paraquat is a very effective preparation against leaf blight, even at 5 ml per litre of water, but leaves are "frozen" on the plant, so that leaf fall is poor. Sprays containing this product as an additive should be used at very low concentrations.

Weed control

A number of weedkillers for the control of broad-leaved weeds were tested on cotton. Very good control was obtained with fluometuron and prometryn used as pre-emergence preparations or mixed half and half. The residual action of sianazine was very short, however. The effect of the preparation diuron when used with a weedkiller provided unsatisfactory control of weeds.

The application of these preparations late in the season (middle of January) produced very good control of broad-leaved weeds up to harvesting time.

The only registered preparation for the control of *Cyperus rotundus*, namely MSMA, produces unpredictable results and only suppressed this problem weed for a short time. There are indications that higher doses than the prescribed three litres per ha could ensure better results and further investigations will be started.

A new compound, fluridone, controlled nutgrass, grasses and broad-leaved weeds for the entire growing season, but unfortunately also proved phytotoxic to the cotton. Further investigations will be carried out so that the method can be adapted in order to reduce the damage done to the cotton seedlings. The cotton recovers from this check in its growth during the

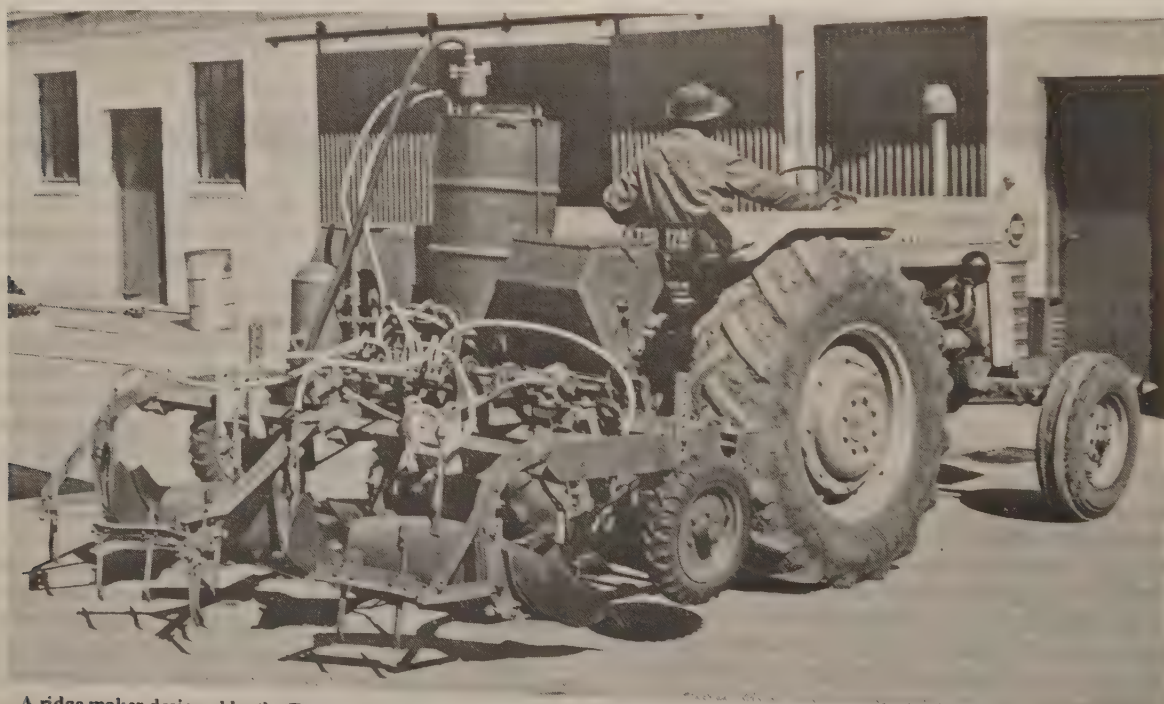
flowering stage, after which the plants recover very well.

Fertilising

The depletion trial was continued during 1977/78. As in the past, nitrogen boosted growth and yield considerably. The relationship between the amount of nitrogen applied and the plant height, number of bolls per plant and yield is a significant and direct one ($r=0,93$; $0,96$; $0,97$) up to the level of 200 kg of N per ha. There is a very close relationship between plant heights, yield and number of bolls per plant, with correlation coefficients of $r=0,95$ and $r=0,99$, respectively. The contribution of P and K fertilising still does not appear to be significant, despite the fact that the trial has been in progress on the same plots since 1971.

TOBACCO

The basic aim of boosting tobacco production while maintaining quality was successfully pursued in the research programme. The spectrum of resistance to diseases and pests of tobacco cultivars was enlarged and the production capacity of the breeding strains increased. Low-profile production in order to boost the yield and the chemical control of diseases, pests, weeds and suckers were successfully studied. In addition, the nutritional and water requirements of the tobacco plant, the harvesting and curing of the ripe leaves and mechanisation with a view to labour-saving were investigated.



A ridge maker designed by the Tobacco Research Institute. It can also be used for applying fertiliser and weedicides. Planting tobacco on ridges gives good protection against drowning and the leaching of nutrients



Mass driers have become common on many farms where flue-curing tobacco is grown

Breeding and selection

Flue-cured tobacco

Resistance to diseases remains a requirement for successful tobacco production. A great deal of attention was therefore given to breeding for resistance to diseases. It has been found that cultivars of flue-cured tobacco that are resistant to races 1 and 2 of the black shank fungus *Phytophthora nicotianae* (B. de Haan) var. *nicotianae* are susceptible to a hitherto unknown race of the fungus. However, surveys have shown that this race is not widespread and that tobacco soils are not heavily infected. This isolate of the fungus is known as race 3. A breeding strain, TL33/3, which is also resistant to this race, was selected and considerable progress has already been made in obtaining broad horizontal resistance to all known races of the black shank fungus in South Africa.

Black root rot *Thielaviopsis basicola* occurs in many tobacco soils, where it causes crop losses. The resistance of B64 of *Nicotiana debneyi* was transmitted to flue-cured tobacco by means of crossings. Breeding strains were obtained that are resistant to powdery mildew *Erysiphe cichoracearum*, tobacco (shank) mosaic virus, black shank and black root rot, and some of these strains were included in yield trials.

The increasing threat to tobacco by the potato virus Y (PVY) necessitated breeding for resistance. The transmission of resistance was effected from a single known source.

Resistance to rootknot nematode could contribute directly to a reduction in tobacco production costs. Strains that already possess the qualities of flue-cured tobacco to a large extent remained relatively free from attacks by the pest, even on soils that were heavily infested with rootknot nematode.

Yield trials have shown that up to now it has been possible to maintain and even improve production and quality while breeding for resistance to diseases. Special techniques are employed to speed up the breeding programme. Factors such as the so-called "pale yellow", which results in a considerable reduction in the chlorophyll content of ripening tobacco leaves, produce rapid yellowing during curing and are being transmitted to the flue-cured tobacco strains.

Burley tobacco

Indications have been found that black shank is threatening (shank) Burley tobacco to an increasing extent. Promising breeding strains have been obtained that are resistant to powdery mildew, tobacco mosaic virus and races 1 and 2 of black

shank. They have already been included in the cultivar trials and will soon be considered for release.

Air-cured tobacco

In the case of light and dark air-cured tobacco there is a need for disease-resistant cultivars that will produce high yields of good quality tobacco. Seed of the breeding strain CL8, which is resistant to tobacco mosaic virus, powdery mildew and black shank, was multiplied and will be made available to tobacco producers. The same resistance was retained in the crossed progeny of CL8 and six American cultivars. The *Nicotiana debneyi* type of resistance of black root rot was successfully transmitted to CL8, the resistance of the latter to other diseases being retained at the same time.

Oriental tobacco

In certain cultivation areas in the Western Cape powdery mildew is severe and there is a strong possibility that tobacco mosaic virus and black shank could also threaten the crop. The strains which are being tested in the area at present and which are resistant to these pathogens include several high yielders that are being considered for release. Provision was made in the breeding programme for transmitting resistance to rootknot nematode.

Planting methods

Flue-cured tobacco

It is necessary to raise the tobacco yield per ha and the price per kg in order to cope with rising production costs. A considerable increase in the production of flue-cured tobacco was obtained with the low-profile methods. The planting of double rows with an espacement of 250 mm in the row, produces a high plant population of 80 000 per ha. With a topping depth of 8 leaves per plant, 640 000 leaves per ha were produced. This procedure produced a considerably higher yield and income per ha than was obtained with the conventional method.

To ensure the best results from low-profile production, only suitable cultivars should be used and sufficient nitrogenous fertiliser should be applied. These factors, namely a suitable cultivar and adequate nitrogenous fertilising, are also critical in determining the quality of low-profile tobacco.

Light air-cured tobacco

There is a need for production practices that will improve both the yield and the quality of this type of tobacco. Good leaf development, production and quality were obtained with low-profile cultivation. Double rows, 250 mm apart, with inter-rows spaces of 750 mm and a plant espacement of 250 mm in the rows, were used.

Topping was carried out to a depth of six or seven leaves per plant.

Dark air-cured tobacco

The conventional production methods of wide espacement and deep topping often produce low yields in dark air-cured tobacco. In low-profile trials in which the plant population was increased considerably and the leaf numbers per plant reduced, large dark leaves were produced and the yield was boosted considerably.

Burley tobacco

The quality requirements for Burley tobacco are high. This type of tobacco is eminently suited to low-profile production. Denser espacement combined with deeper topping of plants produced the best results throughout. These leaf losses, which are usually high with whole-plant harvesting, were lower with these procedures, and the tobacco was of a satisfactory colour and quality.

Oriental tobacco

Owing to the extremely intensive nature of this crop there is an especial need for labour-saving procedures that will also promote increased production per ha. Denser espacement of plants and smaller numbers of leaves per plant made it possible to apply whole-plant harvesting without reducing production. The most promising results were obtained with double rows, 250 mm apart, with inter-row spaces of 500 mm, and espacement of 100 mm in the row and 14 leaves instead of 28 leaves per plant.

Feeding and growth

Fertilising with nitrogenous and potassium fertilisers

Early applications of nitrogen had no adverse effect on the ripening and curing of flue-cured tobacco. Early applications of potassium did not result in an increase in the potassium concentration of the dried leaves.

Growth and respiration studies with flue-cured tobacco

The respiration rate is very high during cell division, drops during cell growth and reaches its lowest point at maximum growth. About four hours after harvesting it increases again and peaks 18 hours after harvesting, then drops with the death of the leaves until it reaches zero.

It was found that leaf produces the highest yield, followed by cutters, top leaves and lugs. The optimum stage of maturity follows maximum yield and is accompanied by a yield loss which increases in proportion to the distance of the leaf from the bottom of the stem. The curing process produces a further loss of dry matter and there is a direct relationship between this loss and the duration of the yellowing stage of the curing process.

Harvesting methods

Flue-cured tobacco

It is often necessary to adapt harvesting procedures to weather conditions. Although once-over is very successful with low-profile flue-cured tobacco, the bottom leaves ripen very rapidly during very wet periods. To prevent over-maturity, it is necessary to harvest such leaves early enough. This tendency to over-maturity varies according to the cultivar.

Oriental tobacco

Although whole-plant harvesting of Oriental tobacco produces lower yields than leaf harvesting, it saves so much labour that it should be considered. The picking of the lower 12 to 16 leaves, followed by whole-plant harvesting of the rest, ensures high production, but the different cultivars do not show this positive response to the same degree. If the plants are closely spaced and the number of leaves per plant are limited, satisfactory yields are also obtained with whole-plant harvesting without it being preceded by leaf harvesting.

Cultural practices

Induced ripening

Accelerated ripening is important for the tobacco farmer. It makes it easier for him to make full use of his expensive drying facilities and avoid leaf spot diseases. Although the ripening agent ethrel is effective on mature leaves under conditions favourable to ripening, it had very little effect on the production capacity of flue-cured tobacco and the chemical composition of the dried leaves. It also accelerated the ripening of light air-cured and Burley tobacco. Ethylene gas at 25 ppm reduced the yellowing period of ripe flue-cured tobacco leaves by 25 per cent, but had no effect on the yellowing period of over-ripe leaves.

Sucker control

Chemical sucker control, and its mechanisation, is becoming increasingly important as labour becomes scarcer and more expensive. Semi-systemic preparations such as Tamex and Acotab produced results comparable to those obtained with fatty alcohols such as Off-Shoot-T and Deca and comparable results were also obtained with manual application and spraying of all these sucker preparations.

Weed control

The mechanical control of weeds such as annual grasses and brown nutgrass *Cyperus rotundus* is expensive and extremely ineffective during wet weather. The weedkillers Destun and Tillam produced good control of these weeds with the recommended quantities and methods of application. In addition, Paarlan, Planavin, Stomp,

Dual and Ronstar, like Destun and Tillam, produced good control of annual grasses and certain broad-leaved weeds.

Irrigation

Owing to the poor distribution of the rainfall in most of the tobacco areas of South Africa, irrigation of this crop is very important. The water requirements of tobacco can only be effectively supplemented by sprinkler irrigation. The use of planting ridges and sprinkler irrigation on heavy soils prevented the irrigation from contributing to waterlogging. During the first few weeks after planting the water requirements of tobacco are low and irrigation is usually unnecessary.

Curing

The effect of wind velocities in the bulk curer on the quality of flue-cured tobacco

It is important that a balance should be maintained between the rate of chemical change in the leaf and the rate of moisture loss during curing. Air exchange is one of the factors that affect this balance. An air exchange of 2,0 m³/loading frame/minute produced optimum results.

Moisture control of circulating air in the bulk curer

Moisture control is usually extended in the circulating air of the curer by placing a wet bulb Sensor in the intake air current of the curer. It was established that the moisture can be effectively controlled with a dry bulb Sensor at the exhaust air current provided the exhaust air is 100 % saturated with moisture.

Loading density of tobacco in loading frames in the bulk curer

It is essential to make full use of bulk curers in order to save time and fuel. Depending on the leaf size, the loading mass should be 50 to 60 kg of fresh, green leaves per loading frame. Reducing the loading mass to 25 to 30 kg per loading frame did not reduce the curing time proportionally.

Curing trials with a commercial curer

With the same curing schedule a small experimental bulk curer with nine loading frames gave the same curing results as a large curer with 162 loading frames.

Curing trials with low-profile and conventional tobacco

Since low-profile tobacco can be successfully subjected to whole-plant harvesting and the procedure is capable of being mechanised, curing trials with conventionally flue-cured tobacco leaves, low-profile tobacco leaves and low-profile whole-plant harvested plants were undertaken. The latter can be successfully cured in a bulk curer

provided an even loading density in each loading frame is ensured. In whole-plant harvested tobacco a partial translocation of sugars and other soluble substances from the leaf to the stem was observed; this takes place when moisture is lost more rapidly from the leaf than from the stem.

Curing of Burley tobacco in the bulk curer

The successful bulk curing of Burley has possibilities for mechanised harvesting and consequent labour saving. Although the problem of rotting tobacco was overcome by means of an adapted curing schedule, the aroma was still unacceptable.

Quality

Sorting trials with flue-cured tobacco

The simplification of tobacco sorting will help to reduce labour requirements. In a trial in which the number of conventional classes was reduced from 10 to 5 by a process of group grade sorting, the sorting rate was raised from 5,97 kg of tobacco per sorter per hour to 7,03 kg. There were no significant differences in the price per kg. However, there was a considerable reduction in the percentage quality deviation from the norm in the 5 class procedure. Group grade sorting has limited advantages for the producer.

Reconstituted tobacco

Reconstituted tobacco was prepared from scrap tobacco and had an acceptable texture and resistance to breakage. Its chemical composition compared favourably with that of the original material for which it was prepared.

Fermentation of flue-cured tobacco

The average price and organoleptic properties of green flue-cured tobacco were improved by light artificial fermentation. This improvement was only possible in tobacco that was not physiologically unripe at harvesting.

Diseases and pests

Black shank *Phytophthora nicotianae* var. *nicotianae*

Methyl bromide gas (hot and cold) reduced the populations of the black shank fungus in the soil but did not eradicate them. A considerable degree of control was also obtained with prothiocarb. Pot trials showed that at least 200 g of a fungus-oats-sand mixture is required in the soil per 5 litre pot to obtain a constant infection.

Black root rot *Thielaviopsis basicola*

The response of 35 *Nicotiana* species, 15 Oriental and 5 other tobacco cultivars to black root rot infection was determined. The species *N. alata*, *N. bigelovii*, *N. longiflora*, *N. debneyi*, *N. exigua*, *N. nudicaulis*, *N. suaveolens*, *N. knightiana*, *N.*

trigonophylla, *N. arentsii* and *N. paniculata* proved to possess high resistance to the fungus, but *N. miersii*, *N. acuminata*, *N. pauciflora*, *N. plumbaginifolia*, *N. megalosiphon* and *N. sylvestris* showed only moderate resistance. The Oriental tobacco cultivar S23C and the ordinary cultivar Bell W3 showed moderate resistance, but DF911 was highly resistant.

Kromnek

Inoculations from kromnek-infected peppers to tobacco resulted in the transmission of the disease and disease symptoms. This shows that peppers can be an important source of infection. It was also found that *Nicotiana glauca* is immune or at least highly resistant to kromnek infection. The utilisation of this source of infection is receiving attention.

Potato virus Y (PVY)

Several attempts at serological identification of the virus were negative. A tube precipitation test with PVY antiserum obtained from Holland produced positive results, however. A suitable host species for the purification of the virus, viz *N. rustica*, was found. A method of freeze drying infected sap for storage as an inoculum was developed.

Leaf curl

A colony of *Bernisia tabaci*, which transmits the leaf curl virus, was successfully maintained. This colony transmits only the vein yellowing component, by means of their eggs. They are also able to obtain and transmit the component(s) that cause severe leaf curl and so produce symptoms such as thickened veins and severe malformation of the lamina. The results provide confirmation that at least two virus components are responsible for leaf curl, one of which can be transmitted by the egg of the white fly.

Nematodes

In comparison with EDB 4,5 %, which is generally used for controlling rootknot nematode, Nemacur produced very promising results and Curater poor results, even at high dosages. These results were obtained on black turf. Vydate, a systemic preparation, was registered for the protection of tobacco on the land against nematodes.

American bollworm

This troublesome pest regularly causes considerable damage to tobacco on the land. A bulk culture of bollworms was successfully maintained. Day-old larvae from this culture were placed on growing tobacco so that the efficacy of various preparations could be compared. Preliminary results indicate that there are big differences in efficacy between the various

preparations. Aerial spraying of lands against bollworm was made far more effective by reducing the width of the spray lanes from 20 to 15 m and mounting the sprayers at an angle of 45° to the front. The phytotoxicity of a large number of preparations differed considerably but phytotoxicity was observed only where the preparations were applied in excessively high quantities.

Cutworm

A cutworm colony is being successfully maintained. The life cycle of the insect can be considered reduced by a change in feeding.

Cigarette beetle and tobacco moth

Although the new pyrethroids were initially effective against the cigarette beetle, it appears that the preparations break down too rapidly on certain surfaces, such as concrete and brickwork. This considerably reduces their value as residual insecticides.

Commodity extension

Farmers' days and study group meetings were held on 27 occasions in the various tobacco production areas of South Africa. These meetings were attended by 580 tobacco farmers and addressed by 11 officers of the Institute. Officers of the Institute paid almost 500 visits to farms in connection with production problems. Almost 600 farmers and other interested persons visited the Institute and the field stations.

About 2 000 soil samples were chemically analysed on behalf of producers to determine fertilising requirements. The full range of pamphlets on tobacco cultivation has been revised and is being reissued.

CHICORY

Despite weather conditions during the first half of the year under review that varied from floods and strong winds to relatively good conditions, overproduction of about 1 800 tons of dried chicory was anticipated. Although farmers generally put in smaller plantings, factors such as better weed control and the absence of leaf diseases and insects led to higher yields. The quality of the root supplied to the drier was average to good on the whole.

During the second half of the year under review the area planted to chicory was obviously larger than the previous year, chiefly because weather conditions were more favourable. Weed control also appears to be better and consequently a good crop is expected if weather conditions do not deteriorate.

The research programme on the chemical control of weeds in chicory proceeded. Because of the variety of soil and weather conditions and the broad spectrum of weeds found throughout the production area it was impossible to make a breakthrough. One problem that emerged from this

investigation was that there has been an increase in the weeds that are not controlled by the chemical herbicides. The reason is that these weeds have to be controlled manually and this is not always done.

At present the planting time for chicory extends from February to as late as September, but this is governed by factors such as rainfall. This extended planting season creates problems for the farmer in his crop rotation programme and for the drier, since chicory is delivered over a long period and full capacity cannot be utilised. In order to obtain more exact information on the best planting time, a trial was started in which a combination of planting and harvesting times was tested.

The local production of seed is still receiving attention and the results of trials have shown that high quality chicory seed can be produced in South Africa. In co-operation with the Chicory Control Board, it is intended to start producing commercial seed for testing in the production area during the coming year.

Good progress was made in the chicory selection programme with the development of a local chicory type. The results of the progeny tests show that yields already exceed those of imported seed.

The chicory production study group is functioning well at present after the formation of subcommittees with specific tasks such as the investigation of the fertilising requirements of chicory, weed control, biature and economic aspects. This group is expected to be of inestimable value to the industry, particularly from the point of view of production.

ANCILLARY RESEARCH

Beetles

Research on *Protostrophus* weevils was continued during the year under review and an interim report on the bio-ecology of several species of the genus *Protostrophus* was completed.

Sixty-eight of the 148 species of *Protostrophus* that have been described are found in the Transvaal Region. Climatic factors and soil types play a big part in the distribution of the various species. Preference is given to sandy and loam soils.

Most of the larvae are found in the upper 300 mm of the soil. Seasonal vertical migrations are caused chiefly by moisture. The larval stage lasts from eight to twelve months. *Protostrophus* larvae feed on plant roots and dead vegetable matter. They are highly resistant to starvation; in fact they may live for up to two years in the soil without food.

The pupal stage occurs during October and November and lasts from 7 to 21 days. The adult weevils of most species emerge from the end of October onwards, the populations reach a peak during December and the weevils disappear from April onwards. The population numbers of adult *P. amplicollis* (Fahrs.) and *P. hamaticollis* (Pér.) also

increase from the end of October onwards, but *P. amplicollis* populations peak between January and March, whereas *P. hamaticollis* populations peak during the winter months.

Two internal parasites, viz *Pandelleia dimorphia* (Curr.) (Tachinidae, Diptera) and a *Perilitus* species (Braconidae, Hymenoptera) parasitise a variety of *Protoctrophus* species. The bio-ecology of the parasites was studied.

Certain spiders, birds and small mammals eat the beetles. In favourable environmental conditions the fungus *Beauveria bassiana* (Bals.) Vuill. kills many *Protoctrophus* beetles.

Trials with insecticides showed that dieldrin is still the most effective.

Termites

Surveys were carried out to evaluate the damage done to field crops in the Transvaal Region by fungus beetles. Considerable damage is done on and around the Springbok Flats, particularly by *Microtermes* species. In some lands over 60 % of the maize and sunflower plants lodge as a result of this pest. Wheat on loam and sandy soils is also badly affected.

The damage appears to be related to the vitality of the plants.

Lupins

The past year, with its exceptionally high and evenly distributed rainfall, was a very good one for lupin production. As a result of these weather conditions, powdery mildew, still the biggest problem in the industry, occurred late in the season and many farmers harvested good crops after only one chemical treatment or even no treatment at all.

Negotiations on the registration of triodimefon and sulphur are in progress. As soon as they have been completed, the control of powdery mildew will become easier and it will be possible to enforce control by law. This should be no problem for the serious lupin farmer, especially in view of the good prices obtained for certified lupin seed intended for export.

However, there were moderate losses in some areas as a result of waterlogging. Very little can be done about this problem.

Other diseases, such as brown leaf spot, occurred in a fairly severe form in a few sweet lupin plantings. Attention is being given to the problem, but a satisfactory solution will be difficult to find because chemical control of this disease would be of a preventive nature, i.e. if a suitable preparation could be found.

Generally speaking, interest in lupins is increasing.

HORTICULTURE

POMES AND DRUPES

Winter Rainfall Region

In contrast to the previous year, when bad weather caused the deciduous fruit industry major

losses, weather conditions in the Western Cape during the past year were favourable for fruit production. In isolated cases severe damage was done by hail, frost, waterlogging, diseases and pests. After a wet winter that ensured sufficient irrigation water for the summer, weather conditions remained favourable during the spring and summer months.

The fruit trees flowered satisfactorily, fruit set was good and the fruit swelled rapidly and regularly during the spring and summer. The apple crop was particularly heavy and the fruit was generally of good quality and size. Although superficial scald occurred in Golden Delicious and sun scald in Granny Smith in certain areas, more cartons were exported than ever before, following reports that stored European apples were very scarce overseas as a result of frost damage during 1977.

Very good prices were obtained despite competition from other countries in the Southern Hemisphere. However, it is not to be expected that it will be easy to sell so many apples at good prices every year, especially since export costs are increasing rapidly. Normal quantities of pears and plums were exported, the demand was very good and exceptionally good prices were obtained. Throughout the export season the demand remained unsatisfied and little competition was experienced.

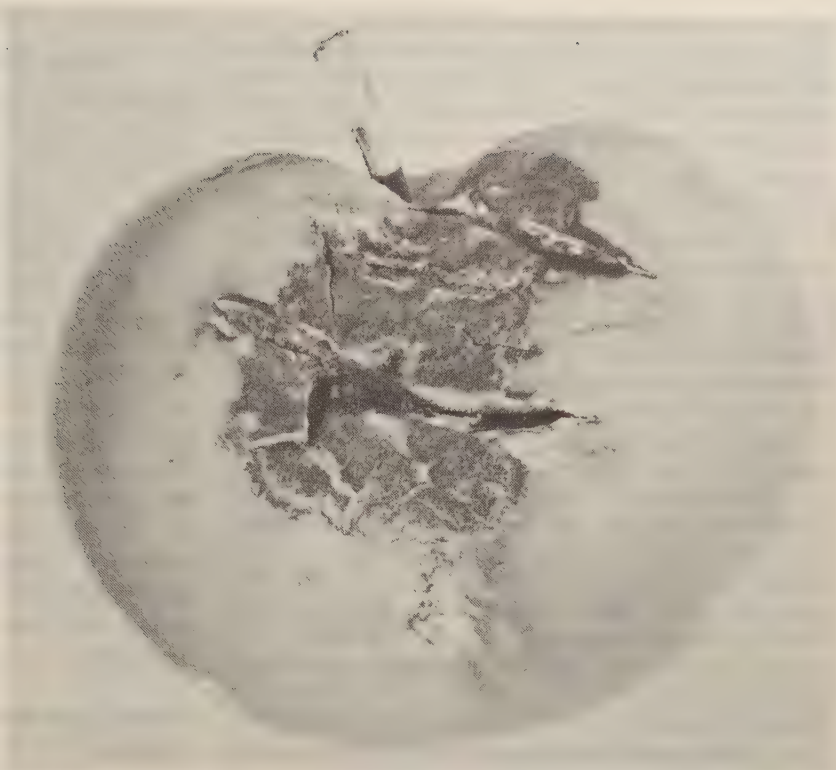
The deciduous fruit industry does not have sufficient good pear, plum, peach and export grape cultivars at present to ensure an orderly supply of these kinds of fruit to overseas markets and one of the most important tasks of the Fruit and Fruit Technology Research Institute is to fill this gap by developing new cultivars that yield well and have a good keeping quality and dessert quality. Breeding and selection are continuing with this end in view and there have been some outstanding successes, such as the release five years ago of two good plum cultivars that have already become very popular overseas and are being planted locally in increasing numbers. A third new locally bred plum cultivar which has very good export qualities was released last year under the name of Reubennel.

It is an irrefutable fact that the progress of the South African deciduous fruit industry today depends largely on successful research. All essential branches of research should therefore be involved in the task and should receive adequate support so that production problems can be identified and eliminated and the future of the deciduous fruit industry, which is extremely important to the country, can be safeguarded.

APPLES

Breeding of new cultivars

The first series of apple seedlings with genetic resistance to apple scab was developed from the breeding programme. They have already been



Very severe fusilcladium infestation on apples

topworked onto suitable rootstocks for the evaluation of their fruit qualities. From an initial population of 8 000 seedlings, derived from a crossing between Golden Delicious and Cox's Orange Pippin, 52 selections have been topworked onto M26 rootstocks and are expected to come into bearing within two years.

Fertilising apples

The results obtained in long-term trials indicated that it is unlikely that a response to phosphate and potassium fertilising will be obtained if the soil contains over 20 ppm of P and 70 ppm of K respectively. Apart from the question of unnecessary expenditure, excessive phosphate fertilising does no direct harm, but excessive applications of potassium can aggravate bitterpit. The provisional standards drawn up for P and K in the soil can therefore serve as guidelines for fertilising, in order to avoid overfertilising.

Progress with research on bitterpit

During a comprehensive survey extending over three seasons the most important orchard factors affecting bitterpit were identified. These factors include a low soil calcium status, a high soil potassium and/or magnesium status, over-luxuriant shoot growth and excessively large fruit. Attempts are now being made to qualify the effect of these factors and so set critical standards to serve as a basis for the prevention of bitterpit.

It will be extremely valuable to the industry to be able to predict the severity of bitterpit at various stages of the season. This matter was studied over three seasons. Although the results

obtained cannot serve as a basis for a reliable method of prediction, they do provide an accurate indication of the critical values for bitterpit-free fruit. For instance, apples will be free of bitterpit if the fruit contains over 11,8 mg of Ca/100 g and under 100 mg of K/100 g in the middle of December. At harvesting time these critical values are respectively over 5,6 mg of C/100 g and under 84 mg of K/100 g.

Analyses of affected bitterpit lesions and comparable healthy tissue showed that calcium accumulates in large quantities in the affected tissue. This finding indicates that bitterpit may be caused by a hitherto unknown compound, probably an organic acid. The ability of calcium to prevent bitterpit may be due to the fact that it has the property of forming an insoluble precipitate with the above-mentioned compound and so rendering it innocuous. This information is the basis for a new hypothesis on the mechanism of bitterpit development which is being investigated by the FF, RI.

Studies on the uptake and transport of calcium

The uptake of calcium by the roots and its transport in apple trees were studied in water culture. Soil acidity is the most important factor that hampers the uptake of calcium. At optimum pH levels excessive nitrogen fertilising produces a reduction in the uptake and transport of calcium, whereas these processes are stimulated by the presence of sufficient phosphorus. Calcium uptake is not much affected by the quantity of calcium in the nutrient medium, but the rate of calcium transport in the plant is largely dependent on the quantity of calcium taken up.

It has been established that slaked lime is far more mobile in soils than agricultural lime and can be used in existing orchards to correct soil acidity in the subsoil. Calcium silicate, on the other hand, is not mobile and its use cannot be recommended.

Pest control

Considerable progress has been made with the control of the codling moth by means of youth hormone analogues that retard chitin formation, and with the aid of certain synthetic pyrethroids. These preparations have the advantage of killing the codling moths at extremely low dosages, which are far safer and may even be innocuous to human beings and animals and possibly also to the natural enemies of other pests of fruit trees.

Development work with one of the pyrethroids, namely permethrin, is so far advanced that the preparation has been registered for the control of codling moth on apples and pears. This spray was also registered for the control of snout beetles in apple orchards and can therefore be used as an alternative or supplement to acephate, which for two seasons was the only registered insecticide for this purpose.

It has been found that apple leaf roller males can be successfully attracted by the female sex pheromone of a related but exotic American species of leaf roller. This is an important breakthrough in that this hormone has already been manufactured synthetically and is generally available. There is now every prospect of introducing a sex pheromone monitoring system for the apple leaf roller. This will make it possible to time the application of control measures as accurately as possible and will lead to more economic control.

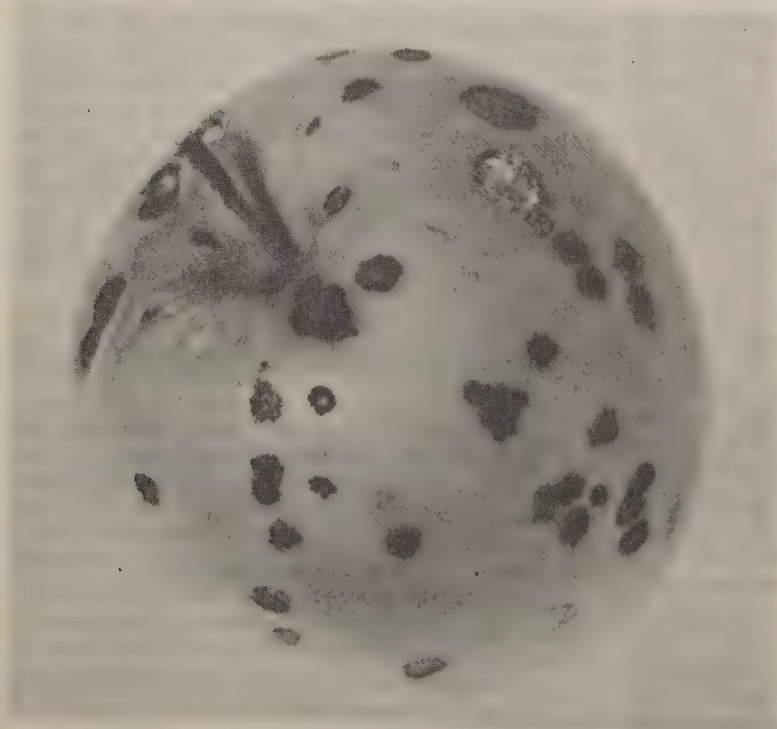
Fusicladium (apple scab)

During investigations into the possibility of introducing an early warning service for apple scab it was established by means of observation apparatus that in most production areas weather conditions during early spring favour the development of *Fusicladium*. According to weather conditions the infection pressure in the Cold Bokkeveld should have been relatively light, but other conditions such as the use of ineffective fungicides, underdosage and untimely spraying were responsible for the initial high scab infection on certain farms in this area. Even in these cases no large-scale losses are expected as a result of storage *Fusicladium*, since there were no long continuous wet periods shortly before harvesting.

A new fungicide, triforine, proved to have an extremely effective curative action during glasshouse trials, but this preparation's protective action was poor in comparison to that of other fungicides.

Chlorination during the hydraulic handling of apples

A hydraulic handling system is used in big commercial apple packhouses to reduce bruising. If the water is used continuously large numbers of fungus spores can collect in it and cause post-harvest rot of the fruit during storage. It was found that a hypochlorite solution with a pH of 5 to 6 and a concentration of 25 ml/l of available chlorine is effective in preventing infection, provided the contact time is at least two minutes.



Late fusicladium infestation on apples

PEARS

New rootstocks for pears

Pears are still grown chiefly on seedling stocks, but there are a number of locally selected clone rootstocks for pears that have considerable potential for the industry. The rootstocks BP-1 and BP-2 have already been released to the industry, and another selection, B-14, is also very promising.

BP-1 is a semi-vigorous rootstock, BP-2 and B-14 grow as vigorously as the seedling rootstocks. The results of trials indicate that all three of these clone rootstocks induce earlier production than seedlings and bear better than trees on seedlings.

If the production of Bon Chrétien and Packham's Triumph on seedling rootstocks is put at 100, production on the other rootstocks was as follows:

Rootstock	Production of Packham's Triumph	Production of Bon Chrétien
B-14	136	188
BP-1	131	174
BP-2	109	159
Seedling	100	100

Quince A, which is so widely used as a pear rootstock in Europe, produces extremely poor trees and cannot be used here.

PEACHES

Breeding of new cultivars

There is an excellent demand overseas at present for freestone yellow-fleshed peaches of good quality. The FFTRI has only one yellow-fleshed selection that seems promising for early release to the industry, viz Selection 10/1. It ripens exceptionally early and is picked from late October to early November. The fruit is of medium size, with yellow flesh and a red skin, and has a good keeping quality.

Other promising yellow-fleshed dessert peaches were produced by the more recent breeding programmes of the FFTRI. At present there are nine of these selections, all of which ripen during January. They bear good and regular crops of attractive fruit and the trees have low cold requirements and a compact growth habit. One of these selections has a very good keeping quality but the other is average in this respect. A number of other selections showed outstanding drying qualities. The evaluation of promising selections is proceeding.

Basic research on nutrient reserves

A complete seasonal study, which has produced a better understanding of the building up, storage and consumption of carbohydrate and nitrogen reserves in one of the most important canning peaches, has now been completed.

A good application of nitrogen during the post-harvest period, after the terminal buds have

already formed, is extremely important because it is conducive to the storage of nitrogen reserves, especially the amino acid arginine, during the winter. The percentage of reproductive buds that develop in flowers and the eventual fruit set benefit from this. During budding nitrogen reserves become depleted, and supplementation is necessary.

Pest control

It has been found that males of the false codling moth, a recently discovered pest of drupes in the Western Cape, can be successfully attracted by a synthetic female sex pheromone of overseas races of the pest. This success increases the chances of developing a sex pheromone monitoring system for this pest, which will make it possible to time the application of control measures accurately and will lead to more economic control.

PLUMS

The breeding of new cultivars

The prospect of releasing a new midseason plum cultivar to the industry was held out last year. The new cultivar, known as Reubennel, was indeed released in 1978 and will help meet the need for improved plum cultivars. The growth, bearing, dessert quality and keeping quality of this cultivar are very good and there is expected to be a keen demand for it overseas.

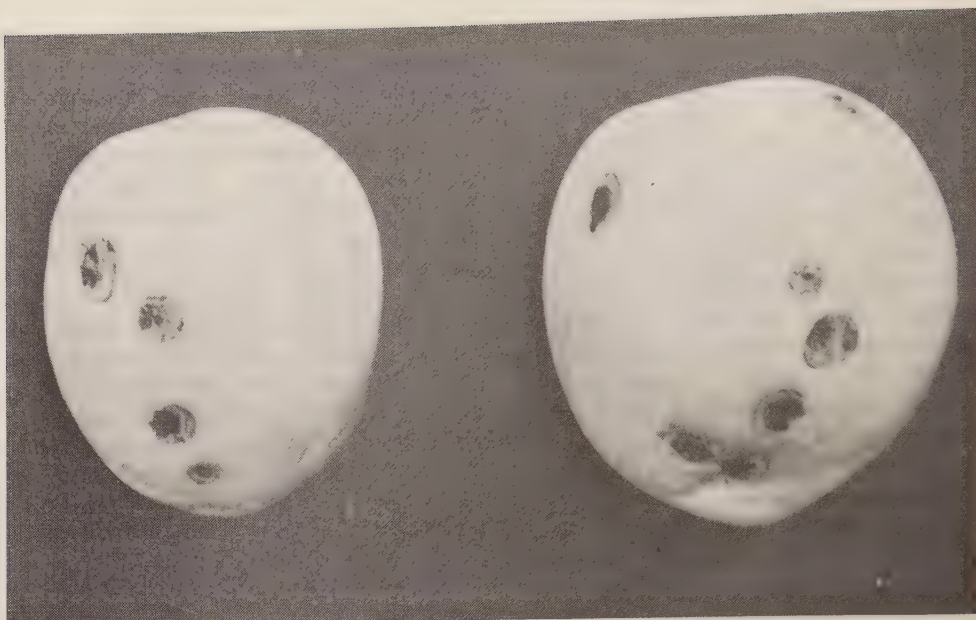
After 16 years of breeding and evaluation five very promising plum rootstocks have been identified. Three of these are semi-dwarfing and have a better yield efficiency than Marianna. The other two rootstocks transmit a high degree of growth vigour to the cultivars grafted onto them.

There are prospects of releasing another new plum selection to the industry shortly. It is coded as 2/58 at present and ripens immediately after Harry Pickstone. This selection, which comes into bearing very early, produced a commercial crop by the second leaf. The quality and keeping quality of the fruit are good and the cultivar is highly resistant to bacterial spot and sun scorch.

Samples of the fruit, consigned by air to West Germany during the past season, were very well received and were sold at the high price of R13 per double-layer tray. There are good prospects of selection 2/58 becoming a very successful new cultivar.

Cultural practices

A long-term trial with Songold plums showed that a permanent cover crop system has a suppressive effect on growth, yield and nutrient uptake. It was also shown that one cannot compensate for this by extra fertilising or irrigation. On the basis of this finding it is recommended that a strip at least as wide as the drip of the trees in the row should be kept clean.



Breeding bacterial-spot (*Xanthomonas pruni*) resistant cultivars is the main aim in plum breeding

Tight-fill packing of plums and pears

The tight-fill packing of fruit has been applied on a commercial scale in the USA for about 15 years now. Last year this matter was researched by Mr Gordon Mitchell of the University of California, assisted by the staff of the FFTRI.

Mainly plums and pears were used for the project at the FFTRI. The first step was to design a plum carton that would be suitable for all cultivars and the most popular counts. A container that takes 10 - 11 kg of plums was found to be the best. The standard export carton was used for pears with great success.

A semi-commercial trial with pears for the local market showed that tight-fill packing sometimes resulted in better market quality than normal manual packing because the fruit is kept immobile during transportation.

MISCELLANEOUS TYPES OF FRUIT

The breeding of strawberry and blackberry cultivars

Progress was also made with the breeding and selection of strawberries and blackberries. A total of 17 very promising strawberry clones are now available for final evaluation. As was predicted last year, it was possible to release a new cultivar - Tiobelle - to the industry in 1978.

Among the blackberries Selection 184 showed excellent canning qualities. It was better in most respects than the canned product of Youngberry, which is the only commercial blackberry cultivar. Selection 184 is being planted for final evaluation on a semi-commercial scale.

TABLE GRAPES

New export table grape

The cultivar Bien Donné, the first table grape bred and evaluated at the FFTRI, which was released in 1977, was placed on the export list for table grapes in 1978. It is an early white grape that does not easily crack as a result of rain and has a very good keeping quality.

Pest control

Good progress was made with the evaluation of prothiophos for the control of the vine mealybug on table grapes. It was found that two sprayings of this insecticide on late table grape cultivars controlled the pest up to eight times as well as the present standard control programmes of three to four sprayings with registered mealybug preparations for late cultivars. However, the problem is excessively high residues and it is hoped that it will be possible to solve this during the next season. Two sprayings of prothiophos against the vine mealybug on late cultivars and one on early and midseason cultivars would mean considerable savings on the cost of controlling this pest. This preparation has not yet been registered for the control of mealybug in table grapes.

Packing in polyethylene bags

There are considerable advantages to packing table grapes in polyethylene bags, which preserve the quality very well. There are, however, two problems with this type of pack, namely the grapes cool very slowly and the wrappers sometimes become damp as a result of the high relative humidity in the sealed polyethylene bags. Research has shown that the slow cooling does not have a

significant effect on the grape quality. The degree of condensation on the wrappers was reduced by ventilating the polyethylene bag with perforations or by using polyethylene linings instead of bags. The use of linings did not result in an increase in rotting and the grape stalks remained almost as fresh as the grapes in the bags.

Uptake of sulphur dioxide by table grapes

Sulphur dioxide is very generally used to control *Botrytis cinerea* spoilage in packed table grapes. At present table grapes are packed in polyethylene bags together with a gas membrane that releases sulphur dioxide.

A survey was carried out to establish how various cultivars can be affected by factors such as delays in pre-cooling, sulphur dioxide absorption by berries and bleaching in these packs.

When the period between packing and cooling is increased there is an increase in sulphur dioxide absorption. Waltham Cross grapes absorbed less but showed more spoilage than Barlinka grapes. However, the gas membrane was only effective for a storage period of three weeks.

FRUIT TECHNOLOGY

The effect of ethepon and cold storage on the quality of dried peaches

Two seasons' research work produced very promising results with ethepon as a pre-harvest treatment for the development of a more even colour in Bulida apricots on ripening. This will produce better colour in the canned product.

A similar problem is experienced with Elberta peaches grown for drying. Owing to high cold requirements, this cultivar flowers unevenly in the Western Cape and consequently the fruit ripens unevenly. Because only table-ripe fruit is desired for drying, several pickings are generally made during the season, but even then it is impossible to harvest all the fruit at the desired stage of ripeness. Pre-harvest spraying with a series of ethepon treatments did not succeed in reducing the length of the harvesting period or improving the quality of the dried product.

The storage of firm ripe and fully ripe Elberta peaches at $-0,5^{\circ}\text{C}$ for 7 to 14 days before drying did improve the quality of the dried product considerably and this matter will be investigated further.

Drying of apples

The use of reject apples for preparing dried apples with a low moisture content was investigated. Very palatable products were obtained by treating fresh apple rings in a suspension of starch and starch derivatives and then drying them under vacuum in a vegetable oil mixture or in a surrogate cocoa butter. By using surrogate cocoa butter it was possible to obtain products that did not have a markedly oily surface. The dried rings

were crisp and retained this property even after long exposure to a moist atmosphere. Of the two apple cultivars tested, namely Golden Delicious and Granny Smith, the latter produced the best products.

Summer Rainfall Area

PEACHES

Production trends

Fruit tree growers are agreed that the peach cultivars bred and released by the Department for the summer rainfall area have boosted the nursery industry in this area considerably. According to reliable growers the demand for young peach trees was fairly static a few years ago, but since the new cultivars were released both demand and sales have risen sharply. In many cases the demand for these cultivars has exceeded the supply.

Although it is not the Department's policy to encourage the planting of peaches in areas with fairly warm winters such as White River and the far northern areas of the Transvaal, more and more farmers are nevertheless tending to plant peaches in these areas. Twelve thousand trees have already been planted in certain parts of the White River district and a few farmers air freighted peaches last season. The indications are that the farmers will export larger quantities of peaches during October and November next season.

Farmers in these areas have become interested in growing peaches because greening in citrus and *Phytophthora* infection in avocados have increased to such an extent that these crops cannot be profitably grown anymore. Although it is possible to grow pecan nuts, the objection is that this crop takes too long to produce an economic yield.

The peach cultivars that can be successfully grown in these areas are Orion, Earlibelle, Albatros and Culemborg. The first three were specifically bred for low cold requirements by the Agricultural Research Institute. The cultivar Imperani, which was specifically bred for the Eastern Free State where late frost is a problem, did very well again this year. Although the peach is a yellow clingstone type, the demand for it on the Durban market where it was sold as a dessert peach was exceptionally good. This peach again produced very good yields of big, attractive and flavoursome fruit. Owing to its adaptability and the good prices obtained, farmers in the Eastern Free State intend to establish larger plantings.

Breeding and selection

Prior to 1973 between 500 and 1000 peach seedlings were evaluated annually. In 1973 the first seedlings were planted according to the high density planting system. Over the past five years 8682 seedlings have been planted in this way and 180 (2%) of the productive seedlings retained for further evaluation.

Owing to the keen demand for yellow dessert nectarines, more attention is being given to this

part of the breeding programme. During the next two years about 1 200 seedlings which are the progeny of nectarine crossings ought to come into bearing. One third of these seedlings should be nectarines.

The two yellow-fleshed dessert peach selections, 551 and 16-14, again performed impressively. Selection 551, a Sunray type which ripens at the same time as Sunray, bore 72 kg of fruit per tree. The fruit had to be thinned again this year. The fruit was only of medium size (57 mm in diameter). The fruit size should not be a drawback, because this is the earliest yellow dessert peach available and good prices are always paid for the first peaches to reach the market. Selection 16-14, which ripens early in December, bore 155 kg of fruit per tree and 67 % of the crop was over 57 mm in size.

The yellow dessert peach selection 1045, which ripens in the middle of November, was also promising. Apart from the fact that the peach flowers late in August, it produces a good crop of medium to large fruit.

Because severe cold did not occur last season in the Eastern Free State it was not a good season for evaluation. The requirement that peach cultivars should flower after 25 August in that area is strictly applied in the evaluation programme. No selections were outstanding and the evaluation work with 8 old and 40 new selections is being continued.

Optimum irrigation level

In an irrigation trial being conducted with peaches the effect of three levels of soil moisture on the yield and quality of the fruit is being studied; this year's results showed that the irrigation level of 80 % withdrawal of available moisture produced the best results.

The total quantity of water (rainfall included) applied to the Hutton soil type was about 1 000 mm, 600 mm of this being rainfall.

Nine-year-old Rhodes trees produced 29 tons of fruit per ha, 57 % of which was over 57 mm in size. Kakamas trees of the same age produced 26 tons per ha; 60 per cent of the fruit was over 57 mm in size.

CHERRIES

After the low cherry crop of the preceding year owing to poor fruit set, cherry producers harvested above-average yields last season. However, hail again impaired the quality.

Cherry producers are becoming increasingly interested in supplying a larger portion of the crop to factories for processing, chiefly because it is easier to handle larger quantities and the factories are now able to process firm red-fleshed cherries as well as the yellow-fleshed types.

The new cultivar Van again bore heavily and the advantages of the good annual fruit set of this cultivar cannot be over-emphasised, especially since poor fruit set affects the cherry industry badly.

As a result of excessively wet soil conditions over the past three seasons, a large number of cherry trees in the Eastern Free State are dying as a result of root dieback.

Rootstock trials

Preliminary results indicate that cherry cultivars with Stockton Morello as the rootstock come into bearing earlier than when they are budded on Mahaleb or Mazzard F12/1. The trees are only four years old, however, and it is too early to draw final conclusions.

Wet conditions, like those experienced during the past three seasons, in soils that drain poorly or only moderately well, were responsible for root dieback and tree losses. At the cherry experimental farm this has only occurred so far on cherry trees with Mahaleb or any of the Mahaleb clones as the rootstock. It appears that the rootstocks Stockton Morello, Mazzard F12/1 and the Mazzard hybrid Fb2/58/48 have greater resistance to temporary waterlogging as a result of their better root spread.

Propagation studies

Propagation studies with cherry rootstocks have reached such an advanced stage that the Mazzard hybrid Fb2/58/48 may be regarded as the most important rootstock. It has a very good affinity with the scion and a well-distributed root system that is not subject to dieback in poorly drained soil. Mahaleb B40, which is regarded as the best rootstock of the Mahaleb clone, is poorly adapted on soils with drainage problems, like all the other Mahaleb types.

Fb 2/58/48 and Mahaleb B40 are easy to multiply by means of hardwood cuttings when treated with 1 000 ppm of indolebutric acid; from 50 % to 80 % of the young trees are suitable for budding. Studies to determine the most suitable planting date for cuttings are proceeding. Results obtained so far indicate that the best rooting of cuttings is obtained when planting is carried out in the middle of May or the middle of July.

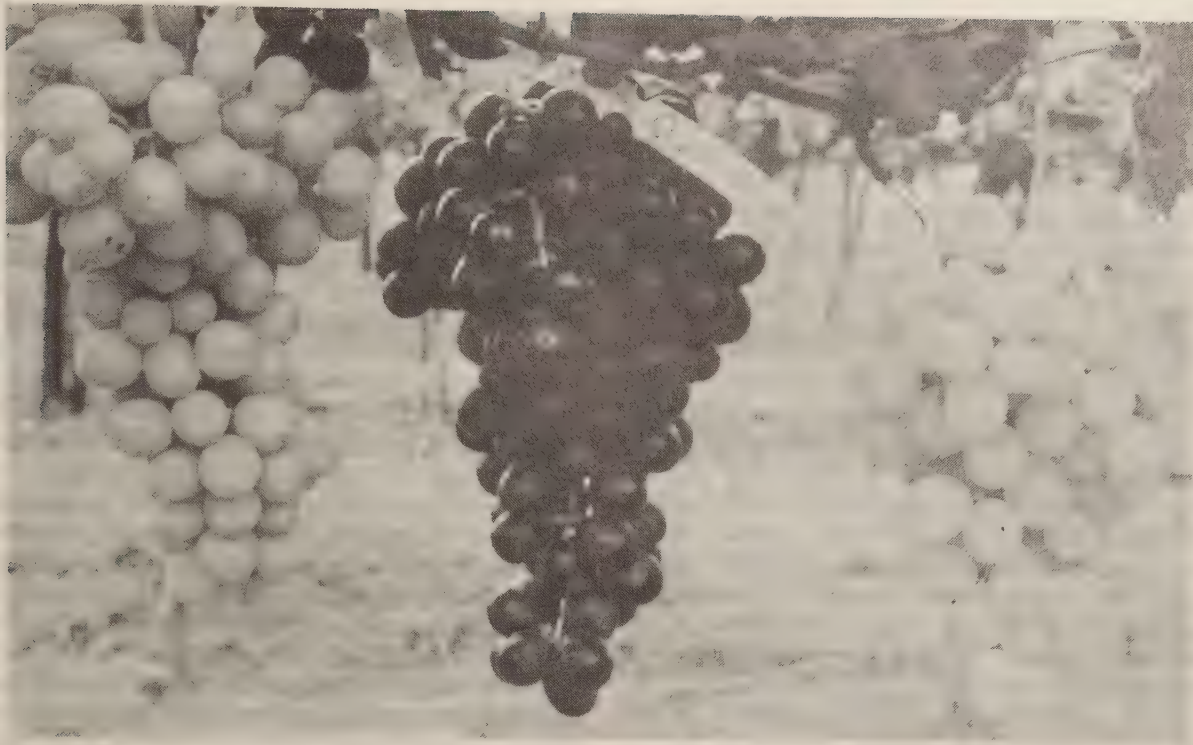
Preliminary results of the rooting of cuttings of the new Mazzard hybrid Fb 2/58/21 (Colt), which has dwarfing properties, are very promising and a take of over 50 % can confidently be expected.

TABLE GRAPES

Production trends

It is clear from the enquiries received and from visits paid to Roodeplaat by farmers that there is considerable interest in planting table grapes in the summer rainfall area. These farmers came chiefly from the Warmbaths, Nylstroom, Vaalwater and Thabazimbi districts.

The serious lack of sufficient grafted material is hampering the rapid development of a table grape industry in the summer rainfall area, however. Apparently grafted or even rooted rootstock material is not easily available. The



A comparison between the early Barlinka type table-grape selection BAR/Q 69-699 (centre), Barlinka (left) and Queen of the Vineyard

reason is that no nurserymen in this area graft grapes on a large scale, although there are indications that certain nurserymen are now interested in doing so locally.

As soon as the young plantings from the Barkly West area come into full bearing, considerably larger volumes of grapes are expected to reach local markets.

Although downy mildew *Plasmopara viticola* occurred again this year, the disease was less serious than in previous years.

Breeding

Of the selections that appeared very promising last year, the early Barlinka type grape, Selection 69-699, which ripens on 3 January, did very well at Roodeplaat again. The berries coloured well, were large (6,4 g), firm and resistant to cracking. This selection and the undermentioned selections again showed notable resistance to cracking this year. During January and February 261 mm and 189 mm of rain, respectively, were recorded at Roodeplaat.

In January it rained for 20 of the 31 days. As a result of the exceptionally wet conditions, the cracking percentage of Queen of the Vineyard and Alphons Lavallée berries was 100 %, whereas only 3 % of Bar/Q 69-699 berries had cracked a month after ripening.

The Department will consider releasing this selection as an early black cultivar during the coming season.

Selection AL/BAR 70-273, which ripens at the beginning of March, was again promising this year. The bunches were well filled, the berries were pitch black with a most attractive bloom, and were again resistant to cracking. A month after ripening no berries had cracked.

The selection BAR/STEYN 70-763 produced the first crop in the evaluation trial this year. The bunches were very attractive, and the berries were big and firm and showed no signs of cracking. This year's results proved irrefutably that cultivars that are highly resistant to cracking can be bred if *Vitis vinefera* breeding parents are used exclusively. Cultivars that also produce big berries can be bred from the progeny.

Over 4 000 grape seedlings were topworked onto established rootstocks during the year. The serious flood that hit the Pretoria area at the end of January did a lot of damage at Roodeplaat as well. About 6 000 grape seedlings and plants were washed away. The crossings will have to be repeated during the coming season.

STRAWBERRIES

Production trends

Interest in growing strawberries in the summer rainfall area has shown no signs of

flagging. Fairly big plantings were established near White River and Barberton this year. These farmers intend to grow the fruit without the aid of tunnels and market it in winter.

Because frost damages or destroys the winter crop in the strawberry growing areas of the summer rainfall area, more and more strawberries are being grown in plastic tunnels. Even the biggest strawberry producer in the country enlarged the area of strawberries grown under cover again this year. This producer now has about 6 ha of strawberries in tunnels.

Protected production not only ensures a bigger winter crop, but also results in a marketable yield of about 30 tons per ha or more being obtained. Before improved cultivars and cultural practices were used, the average yield seldom exceeded 5 tons per ha.

The demand for planting material grown under the Departmental strawberry scheme was again good. It appears that about 100 ha in the summer rainfall area was planted with State-certified material.

The demand for planting material of the various cultivars was as follows:

	Number	Percentage
Selekta	3 000 000	49
Parfaite	1 500 000	24
Tioga	1 500 000	24
Earlibelle	100 000	3

Breeding

Thirty selections and three cultivars were grown in a plastic tunnel and evaluated. The plastic tunnel is usually removed as soon as the weather warms up in August. The tunnel was retained until the end of the season this year and the result was the highest yield ever obtained at Roodeplaat. Parfaite produced 72 tons of marketable fruit per ha. Tiobelle, Tioga and Selekta produced 61, 61 and 58 tons per ha respectively. Thirty-four selections are undergoing further evaluation for yield, fruit quality, resistance to diseases and growth vigour. These selections were specifically selected for firmness and size of the fruit.

During the summer and spring of 1978 symptoms of anthracnose were observed on strawberries grown in the Transvaal Lowveld and in a glasshouse at Roodeplaat. The disease was caused by *Colletotrichum acutatum* and *Colletotrichum fragariae*. The fungus species had never before been observed on South African strawberries.

PECAN NUTS

The average tree yield at Roodeplaat from the four cultivars recommended for Middleveld and Highveld conditions was 65 kg this year. The former best average yield for the four cultivars was 40 kg per tree. The cultivar Moore (20 years old) produced 102 kg per tree, Barton produced 82 kg,

Success 43 kg and Mahan 34 kg per tree. This is the first time that a cultivar has yielded a crop of over 100 kg per tree at Roodeplaat. The increased yield may be ascribed to the fact that far heavier fertilising (particularly nitrogen fertilising) was applied during the past eighteen months.

The cultivar Ukulinga, which is eight years old, produced 18 kg this year.

A pamphlet on pecan growing is already available for prospective pecan farmers in the Transvaal Middleveld and Highveld areas and is obtainable from the Institute on request.

VITICULTURE AND OENOLOGY

The extremely unfavourable weather conditions during the 1976/77 growing season, which resulted in poor fruit set and a severe downy mildew epidemic, were responsible for the fact that the 1977 crop was about 20 % lower than that of previous years. Although it might have been expected that high quality wines would be produced owing to the cooler conditions during the growing season, wines were generally only average, chiefly because of high fixed acid contents, which sometimes resulted in unbalanced wines.

On the other hand the 1977/78 growing season was very favourable. It was relatively cool during most of the growing season and also fairly dry, so that few problems were experienced with fungus diseases. The quality of the grapes at pressing was very good this year. Although the final crop figures for 1978 are not yet known, the general estimate is that the 1978 crop will be at least as good, if not somewhat better than the record 1976 crop. There is a possibility that the six million hl mark will be attained for the first time. Although the 1978 wines are still young, there is every indication that the wines are of average to good quality despite the big crop.

Surveys carried out among producers showed that the pruning recommendations made by the Oenological and Viticultural Research Institute in June 1977 in co-operation with the extension service and the industry made a considerable contribution to the normalisation of the 1978 crop. A further contributory factor to the normalisation of the crop was the very even and high percentage budding of the vineyards during the spring of 1977 owing to the favourable conditions.

The abnormally warm and dry winter which the winter rainfall area in particular is experiencing this season could create severe problems for the wine industry. The OVRI recommended that producers control all cover crops and weeds in their vineyards as soon as possible and leave them on the surface of the soil as far as possible to conserve any moisture present in the soil for the vines. It is also recommended that vineyards receive their final pruning as late as possible to ensure somewhat later budding so that the vines are able to make the best possible use of late rains. Late final pruning will also induce more even budding, which is desirable,

since uneven budding is a possibility after the warm winter.

A breeding programme with scion wine and raisin grape cultivars was started and 16 cultivars were crossed with 80 pollen parents in 60 combinations.

Extremely interesting indications of the possible causes of growth arrestment disease in sultanas in the Lower Orange were found in the course of a research project carried out under the auspices of Prof. W.M. Kliever of California during his 7 months' stay at the OVRI. The indications are that high nitrogen contents and unbalanced reserves in the vines undoubtedly contribute to the development of the problem and these leads are being followed up. Research results obtained by the micro-biology section showed that low must nitrogen contents can be an important reason for "stuck" musts or retarded fermentation. This work, which is proceeding at present, may have important practical value for the industry.

The first heat-treated scion material was made available to the multiplication organisation this year so that the wine industry will at last be able to forge ahead.

The wine market has not recovered although there are encouraging signs that the rate of decline is slowing down. Judging from the prices paid for vines at auctions, producers are still optimistic about an upswing in the wine market in the foreseeable future.

VITICULTURE

Cultivar evaluation

Scion cultivars: first phase

During the past year another five imported cultivars were handed over to the OVRI for evaluation by the quarantine station of the Plant Protection Research Institute (PPRI) at Stellenbosch. There are now 194 imported cultivars on the OVRI's experimental plots which have been established and are ready for first-phase screening. Data were collected from 100 cultivars, clones and crossings, as against 48 the previous year. In addition to last year's 11 new cultivars, the following were selected for inclusion in second-phase trials, i.e. for evaluation in respect of their adaptability in various viticultural areas: Räuschling, Azal branco, Cataratto commune, Callagrano, Aramon blanc, Xarello cataluna, Terret blanc, Ruby Cabernet, Galego farcado, Erlihane, Sylvaner, Flora, Peco 24, MH29/63 and Manseng Superior.

Scion cultivars: second phase

The second-phase evaluation of scion cultivars includes the testing of these cultivars under diverse soil/climatic conditions as they occur on the various experimental farms belonging to the OVRI, and on selected commercial wine farms in various wine-producing areas. Trials on commercial farms form the basis of second-phase evaluation and are

known as inter-planting trials, since the trial actually forms part of a commercial vineyard.

A total of 49 standard newly imported and bred white and red wine grape cultivars are being tested in 28 of these inter-planting trials in 20 different viticultural areas for adaptability, expressed in terms of shoot and crop masses, and wine quality. Wine has already been made three times from three of these trials, and two data years of two other trials have been completed. One data year has been completed for each of the remaining trials, except for five trials that were established in 1977. Yields have varied from 3 tons per ha to 48 tons per ha, and the wine has varied in quality from distilling wine to superior wine. Important trends are already being picked up and it will shortly be possible to make regional recommendations on new plantings on an experimental basis.

Rootstock cultivars: first phase

In a screening/affinity trial at Nietvoorbij it has been clear for three years that Bukettraube has affinity problems with Vivet 15 and Grezot.

Rootstock cultivars: second phase

A rootstock trial in its third year on a Dundee soil series on the Oudtshoorn experimental farm produced its first yield during the past season. Fifteen rootstocks and clones are being tested here with Chenin blanc as the scion. Metallica, Richter 99, 143-B and 101-14 did best, yielding just under 20 tons per ha.

Virus purification of wine and raisin grapes

Scion cultivars

Another 23 cultivars and clones were admitted last season for virus purification by means of heat therapy and 178 cultivars and clones are at present undergoing purification. Virus-free material of Cabernet Sauvignon, Steen (2 clones), Pinotage, St Emilion, Sultana and Korente was admitted to the OVRI's foundation block at Stellenbosch during the past year. Propagating material is supplied to multiplication organisations from the foundation block for multiplication and distribution in the wine and raisin grape industries.

Rootstock cultivars

Another six cultivars and clones were admitted for virus purification and 61 cultivars and clones are being subjected to the process at present. During the past year virus-free material of an additional clone of both Jacquez and Salt Creek was handed over to the multiplication organisation for multiplication and distribution to the industry.

The breeding of new wine and raisin grape cultivars

During the past growing season the OVRI started a breeding programme for new wine and raisin grape cultivars. Sixteen wine and raisin grape cultivars were crossed with 30 pollen parents in 60 combinations and a good crop of seed, which will shortly be planted, was obtained. The aims of the breeding programme are:

- The improvement of the viticultural adaptation of cultivars. Breeding will be undertaken for resistance to disease, a better spread of the crop (early and late varieties are being selected), good fertility of fruit canes and long bunches - both of which are properties that make harvesting easier and are conducive to big crops.
- The improvement of the quality characteristics.

What the trade requires of wine grapes at the moment is new flavours and tastes, provided other recognised wine quality characteristics can be retained. The present commercial raisin grape cultivars produce good quality products but have certain viticultural drawbacks, such as the susceptibility of Sultanas to growth arrestment disease, that of Hanepoot to crown gall and Korente's tendency to produce low yields. New raisin grape cultivars should be equivalent or superior in quality and appearance because the new products will have to compete with the above-mentioned cultivars on the established markets.

Grafting and nursery practices

Illuminating results were obtained from the 27 treatments investigated during the 1976/77 grafting season. Prior to planting a grafted vine uses about 60 % of its initial carbohydrate reserves, chiefly for callus formation around the graft union and for bud break of the graft buds, if artificial callusing is carried out at 28 °C for four to five weeks. An increase in carbohydrate consumption can clearly be seen during the callusing period. However, cold callusing, which is at present applied by the majority of nurserymen, uses only 38 % of the initial total carbohydrate reserves prior to planting. This indicates that a grafted vine that has undergone hot callusing is planted with only about 40 % of its initial carbohydrate reserves, with which it still has to form roots in the nursery. This illustrates the necessity for well-drained, warm nursery soils, and a favourable climate during the critical stage following transplanting, so that the energy-poor vine can root and develop aerial growth as fast as possible.

During the 1977/78 nursery season no differences were observed between the percentage take of cold-callused vines and that of vines subjected to hot callusing for three to five weeks. In comparative studies a better percentage take was obtained with callused vines than with uncalled vines.

Cold storage at 2 °C after callusing for up to five months produced promising results, and this treatment produced a higher percentage take than any of the other grafting treatments. This enables nurserymen to graft and callus early and place the vines in cold storage until nursery conditions are suitable for planting. The early collection of grafting material (May) appears to produce the best results, although the percentage take is not related in all cases to the total carbohydrate reserves of the vines upon collection.

The callusing of vines in water, which produced comparable percentage takes to those obtained with callusing in sawdust, may be considered as a possible alternative to sawdust, particularly where there is some doubt about the hygienic condition of the sawdust.

The use of black plastic film in the nursery as a cover for both callused and uncalled vines has produced consistently good results for the past three seasons. Where uncalled vines were planted with a temporary plastic cover the percentage take was 20 % higher than where they were planted without this cover. The percentage take of the former was the same as that of callused vines planted in the traditional way. Where the graft and the callused graft union are left above the surface of the soil, together with a plastic cover, the highest percentage take was obtained, and this has the additional advantage of cutting out the need to get rid of scion roots.

Cultural aspects

Establishing vines

The long-term benefits of using a plastic soil cover during the establishment of vines under dryland conditions are clear from the fact that good results are still obtained in respect of growth, bearing and root development up to the fourth and fifth growing season after planting. During the fourth growing season the production from vines established under plastic was 1,8 tons per ha higher than that from vines established by the conventional method. If the plastic is covered with soil it lasts longer (up to three seasons), which results in big savings on the cost of weed control (R80 per ha).

Very interesting results were also obtained when basins were built around the vines at establishment and various quantities of water applied at fixed periods. When a particular volume of water was applied over a fixed period of a month, in smaller payments at shorter intervals, the available water was far more efficiently utilised by the vines and the total growth of the vines increased by an average of 120 %. It was found that where a single application of water produced a certain growth response in vines, the same response could be obtained with half the quantity of water, provided it was applied in four payments at shorter intervals.

Promising results were also obtained with various mulches, applied in basins, with or without

supplementary irrigation water. Without any additional irrigation (dryland) the plastic cover in the basins again produced the best results in that the shoot masses were virtually twice as high as with the second best type of cover, viz gravel and coarse white sand. A chaff mulch during establishment produced no improvement in comparison with the control, where no mulch was used. When a single irrigation of 12 litres per month was applied in the basins, with the various mulches, shoot growth increased by an average of 367 %, and the plastic cover was again responsible for the biggest increase, viz 806 %. An important conclusion that can be drawn from the results of this trial is that the effect of plastic soil covers under dryland conditions on the growth and development of the vines is similar to that of an irrigation of 4 litres a week, or about 14 mm a week. This observation underlines the advantages of using the plastic soil cover.

The results of these trials are very important to producers who have to establish vines under dryland conditions and could do a great deal to eliminate "gappiness" in vineyards, which would boost the yield per unit area considerably.

Growth arrestment disease

Growth arrestment disease is a unique regional condition that occurs chiefly in sultanas along the Lower Orange River. The characteristics of this condition are poor budding of the eyes, followed by a cessation of spring growth early in the growing season, with a resumption of growth later on in the growing season, but with a few or no bunches on the canes. The well-known grapevine physiologist, Dr W.M. Kliever of the University of California, researched this problem locally for six months during the past growing season. In all cases a considerably higher nitrogen content was found in the plant organs of affected vines than in healthy vines. The content of the amino acid arginine, which serves as a criterion for the internal nitrogen status of the plant, was found to be from 40 % to over 400 % higher in the affected vines. These figures were also higher than the arginine contents of normal vines in California. This finding, and the increased incidence of the disease on richer, heavier soils, indicate that an excessively rich growth medium and high nitrogen status may be contributory factors in this disease. This hypothesis is supported by the finding that a sultana vineyard at the Upington Research Station, which had been diseased for eight successive years, recovered and has remained healthy for two years after a heavy nitrogen consumer, namely Wimmera rye-grass, was sown in the vineyard. These leads are being followed up in further trials.

In addition, an attempt is being made to prevent the disease by making use of the heritable resistance of cultivars. Ungrafted cultivars that have clearly proved to be more resistant than ungrafted Sultana over the past three seasons were the wine grapes Colombard, Chenin blanc, Muscadet and

the raisin variety Black Monucca. Rootstocks capable of reducing this problem are also being sought. It was found that Sultana grafted on the rootstock 26G produced good yields regularly without any symptoms of the growth arrestment syndrome.

Weed control

A. Chemical weedkillers

The screening of weedkillers was continued with the aim of finding the safest, most effective and cheapest preparations for grapevines. Forty-five pre-emergence preparations were tested against annual weed seedlings. Twenty-two soil-residual and ten leaf-absorbed weedkillers were tested against established common quick grass and other quick varieties.

1. *Pre-emergence preparations against seedling weeds*

In the course of a further screening of the most promising preparations of the previous season, the best comprehensive control was obtained with simazine, a simazine-nitralin mixture, terbuthylazine and Ustilan. In the low doses (1,5 kg/ha) used in the investigation, Ustilan was found to be safe in respect of root uptake by the vine. The sensitivity of vine roots to the higher minimum doses required to control common quick grass, blue quick grass and tussock paspalum (about 3 kg/ha) has still to be determined. In addition to these preparations a whole range of mixtures could be made up of preparations that do not control the entire spectrum of weeds themselves but are able to do so when used in combination. Further screening in respect of the cost of preparations and the duration of the control provided is being undertaken at present.

2. *Soil-residual root-absorbed preparations against perennial weeds*

The possibility of killing established stands of quick grass through uptake by the roots of weedkillers washed into the soil during sprinkler irrigation was investigated. A wide range of preparations were tested separately and together against common quick grass *Cynodon dactylon* of which the aerial parts had previously been killed by scorching with paraquat. Adequate control was obtained with preparations such as proprop (Dalapon), amitrole and terbacil, which are known to harm the vines if taken up by the roots. Promising initial control (two months after application) was also obtained with Ustilan and ethofumesate, which are probably safer, and certain combinations of Maloran, metolachlor, oxyfluorfen and norflurazon also seem promising.

3. Post-emergence leaf-absorbed preparations against perennial weeds

A replacement is being sought for glyphosate, which is safe and effective but very expensive. The preparation that comes closest to glyphosate in respect of good systemic control (i.e. little re-growth) is HOE29152, a systemic herbicide. It provides good control of the two most important quick species in the vineyard, namely common quick grass and blue quick *Paspalum distichum*, but is less effective or ineffective against other less important quick species such as kikuyu, buffalo quick *Panicum coloratum* and Johnson grass. It controls no broad-leaved weeds and is very safe for use in the vineyard, even when there is leaf contact. There are no indications of when the preparation will be marketed. Trials were also carried out with combinations of the above soil-residual preparations and various scorching and leaf-systemic preparations, so that complementary combinations could be found and the period of control extended. As in the above case, favourable preliminary results were obtained, but final evaluation will depend on next season's re-growth.

B. Biological weed control

Certain annual winter cover crops are capable of keeping weeds in vineyards down through competition and their dead residues provide a certain amount of control of summer weed seedlings prior to emergence. For the best effect the soil should be sufficiently fertile for the maintenance of good growth vigour in the cover crops. Cover crops should be sown early, preferably in April, and should not be subjected to drought. Four *Medicago* clover species, three subterranean clovers, three vetch species and one rye-grass were studied on various soil types at Nietvoorbij and various farms in the Stellenbosch district. The most effective was the subterranean clover Clare, the sweet and purple vetches and *Vimvera* rye-grass. These crops re-established themselves well, but their growing seasons proved to be too long and they would have to be killed by spraying to prevent competition with the vines. As an alternative, additional irrigation (and nitrogen fertilising in the case of *Wimmera*) would have to be applied. Dead residues of the clovers (*Medicago* spp.) provided good pre-emergence control of summer weed seedlings, but were not really able to compete with some of the hardy winter weeds. The herbicidal action of the dead plant matter is cancelled out if the soil is disturbed, however. A minimum tillage system is therefore required, which should cut down considerably on the costs of labour, fuel, herbicides, wear and tear on implements and fertilising.

Soil type and wine quality

Results obtained over a period of three years have shown that the sandy duplex soils common in the Stellenbosch district and considered of limited

potential are in fact able to produce modest but consistent yields and quality, especially during years when moisture deficiencies occur in the more highly rated red soils. During wet years (such as 1977), however, it would appear that the red soils, unlike the duplex soils, benefit from the higher rainfall.

It appears that the quality of a large-berried cultivar such as Cinsaut is very easily affected by the moisture supply and the crop. As soon as the moisture supply and crop become excessive the quality drops. Therefore, although Cinsaut is a heavy bearer, it should be cultivated like a shy bearer if dependable quality is to be obtained. When Cinsaut is grown as a quality variety it should therefore preferably be planted on soil and under climatic conditions where low to moderate growth and bearing can be expected.

Cultural practices

The principles of cultivation in dryland conditions have largely been established and cultural practices under irrigated conditions are being studied at present. Although there had been no reduction in the crop after three seasons of observation, it is clear that an actively growing cover crop does compete with the vines, even where there is an adequate supply of moisture. This causes weaker shoot growth and there is every evidence that an increasing nitrogen deficiency is responsible. This result suggests the interesting possibility of using cover crops to regulate the nitrogen status of vineyards showing over-luxuriant growth or of using nitrogen-fixing cover crops in vineyards that are growing less luxuriantly to supplement the supplies of nitrogen.

Fertilising studies

After the fifth season of differential fertilising on a piece of land in the Stellenbosch district that was poorly supplied with the macronutrients, there are signs that the vineyard is starting to respond to fertilising. Nitrogen fertilising has stimulated shoot growth over the past two seasons and last season it resulted in an increase in the crop as well. It would appear that P and K are also starting to have a positive effect on shoot growth and production, although their effect varies with the season and long-term data are required before final conclusions can be drawn.

Under irrigated conditions at Lutzville it could be seen that after the fifth season of fertilising the vines that had not been fertilised looked yellower. Leaf analyses showed that the leaves contained about 17% less nitrogen, but no effect on shoot growth or bearing has yet been observed on these relatively fertile soils. This result indicates that the regulation of nitrogen fertilising of vines can largely be done by visual means without any risk to the crop.

Entomology

Margarodes

Certain aspects in connection with the biology of a *Margarodes* species that causes severe damage in vineyards in the Olifants River irrigation area were studied. In the course of laboratory observations it was found that adult females emerged from the cysts during January and February and that only 10 to 15 per cent of the cysts developed into females annually. Cysts were kept without food or water for four years and females developed from these populations annually. If an infested vineyard is lifted and re-planting carried out only after four years, the new vines may also become infested.

It was also found that the females do not migrate to the surface of the soil for mating but propagate themselves by means of parthenogenesis. Females lay an average of 507 eggs each, but up to 1 238 may be produced per female. Oviposition is less in dry soil than in moist soil. The incubation period is between 36 and 45 days and more eggs hatch in moist than in dry soil. Flood irrigation as applied in the Vredendal area therefore favours propagation of the insect.

Observations in the field showed that this species may occur at any depth in the soil down to 1,2 m. The highest numbers were found at a depth of 46 to 60 cm.

These findings agree largely with findings on the species that occur on vines in the Malmesbury area and indicate that this pest may be very difficult to control, even by chemical means.

Disease control

Control of *Botrytis cinerea* or grey rot

Trials with a new contact fungicide for use against botrytis showed that this preparation provides better control of the disease than the existing ones. The best control was obtained with a programme spraying of four applications, with 21 day intervals, starting at the pea seed stage. The results also showed that the number of sprayings are more important than the stage at which one sprays. No adverse effects on fermentation and wine quality could be shown. The availability of a fungicide capable of reducing botrytis infection from 24,5 % to 3,5 % and suitable for use up to immediately before harvesting without any adverse effect on fermentation and wine quality has made the control of one of the most important vine diseases considerably easier.

Systemic fungicides against downy mildew

It was found last season that systemic preparations provide better control of downy mildew than the standard preparations. This season the curative effect of Aliette 1710 and Aliette 1733 was tested against that of a standard preparation. Three sprayings were carried out at 14 day intervals on an existing 14,2 % infection. In the case of the

unsprayed control and the standard preparation, the infection increased to 86,2 % and 28,6 % respectively. In the case of Aliette 1710 and Aliette 1733, the infection was reduced to 2,5 % and 3,6 %, however.

The amazing curative effect of the systemic preparations means that producers need not rely on preventive spraying alone, but are able to keep an existing infection down to a minimum.

OENOLOGY

Optimum ripeness in grapes

(a) Pinotage: Stellenbosch

In 1975 and 1976 the best wine quality was obtained from Pinotage grapes at a sugar:acid ratio of 4,2. Last year the acidity of the grapes was very high. In 1976, for instance, the acidity was 7,5 at 22,5 °B and in 1977 the figure was 8,4 g/l. The result was that even at 26 °B in 1977 the 4,2 ratio was not attained. Although this sugar:acid ratio has produced good results in the past, these data show that it is not infallible, particularly in years when the acidity (in terms of °B) is high. In 1977 the best quality was obtained at 24,5 °B (acidity 7,7 g/l). If harvesting had been carried out a week earlier, (23 °B, acid - 7,6 g/l), the wine quality would have been considerably lower (75 as against 64 %).

During all the years of the trial wine quality was found to decline with any drop in the berry volume.

(b) Cabernet: Stellenbosch

During a two-year investigation no connection was found between wine quality and the sugar and acid concentration of the grapes. In 1977 it was possible to harvest from 18,8 °B to 21,6 °B (4 weeks) without the wines showing any notable differences in quality.

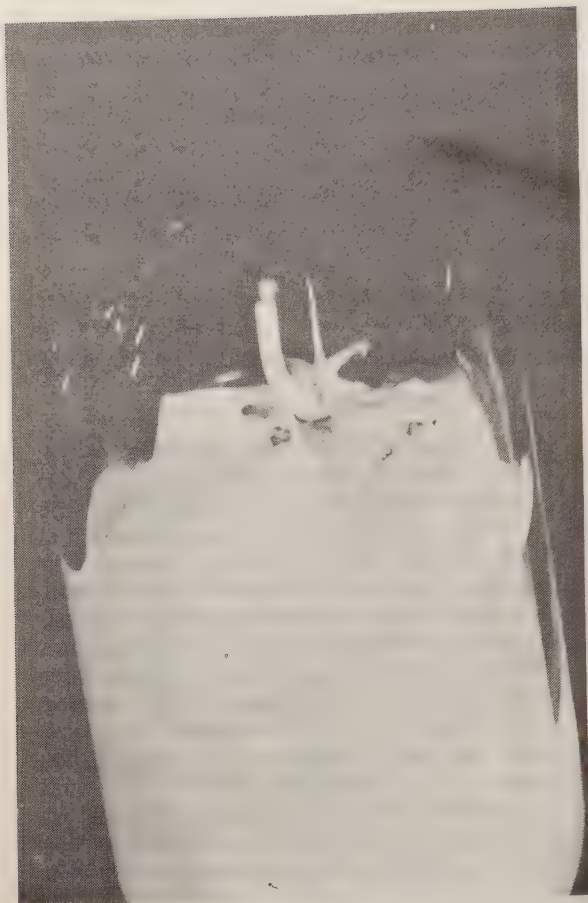
Effect of pH on the esters and wine quality of Colombard wine

When wine was matured for 16 weeks at temperatures of between 0 °C and 30 °C and at three pH values, the acetate esters in the wine dropped drastically at low pH levels and high temperatures. The ethyl esters were far less affected in the above-mentioned group. On the other hand, diethyl succinate increased and the biggest increases occurred at low pH levels and high temperatures.

There was no obvious connection between wine quality and changes in the ester level. The development of a maturation bouquet evidently partly obscured the decline in cultivar character and made it difficult to determine differences in wine quality.

The cadmium content of South African wines

A technical subcommittee of the OIV is at present investigating the cadmium content of wines.



In vitro micro-grafting of a heat-treated Tinta Barrocca wine-grape growth point for the elimination of viruses in the infested parent plant

Because of the possible effect of this element on health, this investigation is being given top priority. A margin of 0,01 mg/l is provisionally - and unofficially - taken as the maximum safe concentration at present. A large number of South African white and red wines were tested and 2,2 % of the samples were found to exceed the provisional limit by 0,001 to 0,005 mg/l. It is thought that contamination of the wines by winery equipment may be responsible for the high cadmium concentration in certain wines.

Maturation of wines

Steen, Riesling and Colombard wines were stored at temperatures of between 0 °C and 30 °C and high, low and natural pH values were regularly analysed and the wines judged for quality.

Ethyl acetate concentrations measured over a period showed a highly significant correlation with the decline in the cultivar character. It was found that there was an extremely high correlation between the maturation bouquet observed by organoleptic means and the dimethyl sulphide concentration.

Cultivars differed in respect of the development of a maturation bouquet. Riesling and Colombard developed pleasant characters, but unpleasant flavours were observed in Steen after a time.

Factors that affect the fermentation

Bentonite is commonly used in practice in wine-making and research on its effect on wine quality is therefore important. The effect of Na bentonite on fermentation depends on the must qualities. In shiny filtered must it stimulates fermentation, but the opposite is often true in clean settled must. Previous studies have shown that the use of bentonite generally favours the formation of aroma substances under normal winery conditions.

Substances that promote yeast growth are obtained from must impurities. The addition of these substances to a sterile filtered must under a nitrogen atmosphere boosted the fermentation rate to about the same as that of a clean settled must. These findings may be of great value in explaining the factors that affect the fermentation and determine the final wine quality.

To investigate the effect of a fungicide on yeasts, a strain of yeast is cultivated on agar medium to which different concentrations of the fungicide has been added



The use of inert gases in wine-making

Wines were covered with CO_2 , Ar and N_2 and mixtures of these gases, and the following results were obtained:

- Antioxidative and antiseptic effect: The gas mantle kept oxygen away from the surface of the wine so that SO_2 was better retained. This resulted in wines being more resistant to oxidation and the development of aerobic micro-organisms such as acetic acid bacteria was prevented.
- Organoleptic effect: The CO_2 concentrations of protected wines were higher and the wines had a fresher appearance. Dissolved CO_2 in a wine can give dry wines a sweeter taste, for instance.
- It was found that covering wines with a gas mixture containing CO_2 and inert gases is a very effective way of regulating the CO_2 content of the wines. By increasing or decreasing concentrations of Ar and N_2 in the CO_2 mixture, a higher or lower CO_2 concentration can eventually be obtained in the wine.

The use of a gas mantle makes it possible to use less SO_2 in wine-making, and better quality wines that are more resistant to oxidation can be obtained.

Malolactic acid fermentation

A taxonomic study was undertaken in which bacteria were isolated from wines from ten different

wineries in the Western Cape. The bacteria were tested for their ability to convert malic acid into lactic acid. In this way 180 different malolactic acid bacteria were isolated, 115 of which were rod-shaped and 65 coccus-shaped bacteria. Good progress has already been made with the identification of these organisms, which will be carried out down to the species level.

Malolactic acid fermentation in red wines

When studies undertaken by Prof. Van Wyk (Department of Oenology, University of Stellenbosch) were followed up it was found that many wines submitted for certification as wines of origin underwent malolactic acid fermentation even after certification. It is of the utmost importance that producers make sure that the malolactic acid fermentation is complete before the wines are bottled.

Nitrogen deficiencies in musts and retarded fermentation

The investigation into the problem of stuck musts proceeded during the year under review. It has already been established that nitrogen plays a cardinal role. Laboratory tests were carried out and it was shown that musts with a low total nitrogen content contain too little assimilable nitrogen for normal yeast multiplication, so that the musts get stuck or are subject to retarded (incomplete) fermentation.



Soil is examined morphologically to determine the effect of soil type on wine quality

Uptake of molecular oxygen in must and wine

The oxidation of musts and young wines is due chiefly to the polyphenol oxidase enzyme. The activity of this enzyme differs to some degree in various cultivars, is low at low temperatures and is severely inhibited for a long time by a combined application of sulphur dioxide and the pasteurisation of the must or wine.

An investigation showed that the rate of oxygen uptake and consequently the risk of oxidation in young wines increased considerably over a period in wines that had been pasteurised and received SO_2 . Where large quantities of oxygen had been taken up by the must, the action of moderate doses of SO_2 was soon neutralised. This led to a lower alcohol concentration and an increase in the acetaldehyde in the wine. From a practical point of view it is therefore desirable for oxidation to be prevented by eliminating the initial uptake of oxygen by the must.

Mechanical harvesting of Chenin blanc

Work on mechanical harvesting was continued with the cultivar Chenin blanc, the most widely planted South African white wine cultivar.

As in the case of the mechanical harvesting of Riesling (1976/77 report) certain parameters, such as the temperature of the grapes during harvesting, contamination with material other than grapes (MOG) during the harvesting process and the keeping period of the grapes from harvesting to processing were again separately and collectively studied.

Grapes were harvested at high temperatures (26°C) and low temperatures (13°C), with low (2 %) and high (12 %) MOG and kept for 1 and 18 hours before processing. Although mechanically harvested Chenin blanc grapes obtained higher points (60 %) than manually harvested grapes (54,6 %), the difference was not significant. The differences in wine quality are statistically significant when the marks awarded differ by 6,8 % ($p = 0,05$) or more.

The results also show that MOG had no effect on the wine quality of mechanically harvested grapes provided the temperature at harvesting was low and the period from harvesting to processing did not exceed 1 hour. Keeping grapes for a period of 18 hours from harvesting to processing had an adverse effect on the wine quality of mechanically harvested grapes, whether they were harvested at low or high temperatures or at low or high MOG. Further research will be carried out to establish

what the maximum period is for which grapes can be kept without affecting the wine quality.

Evaluation of wines from various thermovinification systems

Three heat extraction systems, namely the Gasquet, Imeca and Sernagiotto, were used in the trials. Because the three heat extraction systems differ not only in their capacity but also in their method of operation, wines of Cinsaut and Pinotage were made with the aid of these machines in order to determine their effect on the wine quality and study their performance. The results showed that the machines produced better wines from Pinotage than from Cinsaut grapes, chiefly because of the poor colour of the wines made from Cinsaut. No statistical differences were found in the quality of Pinotage wines made with the aid of the Imeca and Gasquet apparatus. The quality of the Pinotage wines made with the Sernagiotto apparatus was significantly poorer than that of wines made with either the Imeca or the Gasquet. The wine made with Cinsaut grapes using the Imeca system was significantly better than that made with either the Gasquet or the Sernagiotto system.

The total numbers of litres of wine obtained per ton of grapes with the three systems, using Pinotage and Cinsaut grapes, were as follows:

	Gasquet	Sernagiotto	Imeca
Pinotage ℓ /ton	730	590	700
Cinsaut ℓ /ton	750	694	776

LIQUOR CONTROL

1. Wine certification under Act 25 of 1957

Table 1 is a summary of the quantities of the various types of wine certified for sale by the Wine and Spirits Board with an indication of the origin (estate wines included), grape cultivar or vintage, or any combination of these.

TABLE 1 - Certification of wines of origin and cultivar and vintage wines

Type of wine	Total certified	Superior quality		Special quality	
	h/	h/	%	h/	%
Unfortified wines	121 885	5 737	4,7	116 148	95,3
Liqueur and other fortified wines	48 316	1 143	2,5	47 173	97,5
Total	170 201	6 880	4,0	163 321	96,0

In all 7 683 h ℓ (4,3 %) less wine was certified than the previous year, as a result of a 36,3 % drop in the certification of liqueur and other fortified wines. The reason is that wines of this type are certified chiefly for export and exports dropped considerably during the past year.

However, 19 872 h ℓ (19,5 %) more unfortified wine was certified. Of the total of all certified wine, 4,0 % achieved superior grading, as against 1,2 % the previous year.

It is interesting to note that the total quantities of the various types of wine certified, expressed as a percentage of total sales (local sales plus exports) of unfortified and fortified wines amounted to 7,0 % (5,7 %) and 6,7 % (9,6 %), respectively. The figures given in brackets are the corresponding percentages for the previous year.

2. Inspection of wine spirits and rebate brandy

Table 2 shows the activities of the Government Brandy Board with regard to the inspection of all wine alcohol, on a quality basis, which is suitable for the manufacture of potable alcoholic beverages.

TABLE 2 - Certification of rebate wine, rebate brandy and wine spirits

Type of wine or spirits	Total inspected		Approved	% rejected by volume
	Samples	h/	h/	
Rebate wine	1 513	865 695	827 308	4,4
Rebate brandy	413	126 275	124 530	1,4
Wine spirits	552	236 580	233 732	1,2
Low-strength spirits	53	12 540	12 540	-

It is interesting to note that the stocks of wine spirits, and particularly those of rebate brandy, reached a critically low point during 1973 and 1974. It was therefore necessary to distil exceptionally large quantities during 1975/76. However, during the 1976/77 season the total distilling of wine spirits and rebate brandy collectively dropped by 13 %, and during the year under review there was a further decrease of 6 %. This indicates that the above-mentioned shortfall in the stocks of these products has already been made up to meet the estimated needs of the industry.

Although low-strength spirits are not an important item in terms of volume, it is nevertheless notable that the volume distilled during the year under review rose by 88 % (11 025 h ℓ). This product is used almost exclusively for the manufacture of wine aperitifs.

3. Quality control of export liquor

The Wine and Spirits Board inspected 91 588 h ℓ (2 323 samples) of wine and spirits for quality under the Liquor Export Regulations. Of this quantity 91 535 h ℓ (2 304 samples) were certified suitable for export. The percentages of rejections, calculated by volume and number of samples, were therefore 0,06 % and 0,82 % respectively.

The total exports were 27 % lower than those of the previous year. This may be ascribed almost solely to a reduction of 58,8 % (34 760 h ℓ) in bulk exports of sherry and other fortified wines to the United Kingdom, which has always been by far the

biggest importer of South African wines of this type.

On the other hand, there was an encouraging increase of 51% in exports of South African prestige bottled wine, particularly to members of the European Common Market. This may be regarded as an outstanding achievement and can undoubtedly be ascribed largely to the excellent quality of South Africa's natural wines and the high standard set for all export liquor by the Wine and Spirits Board.

4. Control of imported liquor

Under the Liquor Import Regulation strict control is exercised over all imported liquor to ensure that it complies with the requirements of the Wine, Other Fermented Beverages and Spirits Act, Act 25 of 1957, in respect of composition and labelling. This control is applied in close co-operation with the Department of Customs and Excise.

A total of 646 consignments, imported under provisional certificates of removal, were sampled upon arrival at various customs clearing houses and inspected for the purposes mentioned above.

An additional 744 new applications for certificates of removal were received; 618 were favourably considered and 126 rejected on the grounds of failure to comply with the requirements of the Act in respect of composition and/or labelling.

5. Local liquor inspection service

Under the Wine, Other Fermented Beverages and Spirits Act liquor inspectors travelled 66 410 kilometres during the year under review and inspected 1 509 licensed premises where liquor is manufactured or sold in the Republic. In the process 73 086 liquor samples were taken on such premises and subjected to preliminary tests and examined for labelling. 124 suspicious samples were taken and submitted to the Liquor Control Section of the OVRI for further examination and official analysis in terms of the Act. As a result it was recommended to the Department of Justice that prosecutions be instituted in 31 cases. In six cases the accused were found guilty and fined; six admissions of guilt were accepted by the courts and two cases were withdrawn by the prosecutors concerned. The remaining 17 cases have not yet been decided. In one case, which had been adjourned since the previous year, the licence holder was convicted and fined. In addition 15 licence holders and wholesalers were cautioned for minor offences.

6. Routine analyses

The routine analysis laboratory of the OVRI analysed 13 079 liquor samples in comparison with 11 442 samples during the previous year - an increase of 14,3% in its activities.

These services take the form of official analyses for the purposes of control under Act 25 of 1957, which is administered by the Liquor Control Section of the OVRI, and under other acts that apply to liquor and are administered by other Government Departments such as the Departments of Customs and Excise and Justice.

This laboratory is also responsible for routine analyses of all experimental wines produced by research sections of the OVRI and for providing an analytical service for the liquor industry upon request.



The citrus thrips *Scirtothrips aurantii* seen through the scanning electron microscope. An intensive study has been undertaken on the feeding habits of this insect

CITRUS

The citrus industry experienced one of the best years in its history. Gross foreign earnings amounted to R147,3 million (as opposed to R115,5 million in 1976), R98,4 million of which was made up of net foreign exchange earnings. Gross proceeds from the sales of citrus fruit on the local market were about R23 million. The total production amounted to about 470 000 tons.

Research on cultivars, rootstocks, replanting problems, breeding, irrigation, weedkillers and virus purification is still receiving intensive attention.

Virus-free plant material

Good progress has been made with attempts to promote an official citrus improvement scheme. The virus-free material grown on the Messina Experimental Farm will still take a number of years before it is ready for evaluation under conditions where it can be compared with the best available material at present used as a source of parent material. However, the technique of growing point grafting (GPG) which eliminates most viruses promises to provide a short cut. The necessary equipment for the technique has been acquired and the technique mastered and refined to such an extent that it can already be used on a small scale. The first results of tests carried out on plants obtained through GPG by indexing for virus purity will be known within the next few months.

Improved nursery practices

In addition to attempts to grow good, strong virus-free plants, it is also extremely important to produce trees with roots that are free from any parasites such as fungi and nematodes.

Considerable attention was paid during the past year to methods of water and soil sterilisation in the nursery. Both the irrigation water (directly from rivers) and the soil in most nurseries were severely infected with a variety of parasitic organisms.

Water sterilisation is carried out by means of deflocculation and precipitation of colloidal matter, followed by chlorination. Experimental units were erected and should come into operation shortly. At present soil sterilisation is carried out by steaming. A number of variations of standard techniques are being tested to find the most practical and inexpensive methods.

The use of a growth tunnel to accelerate tree growth is being investigated at present.

The possibility of using a growth tunnel for germinating citrus seed in winter and so eliminating the storage of seed is also being investigated. Alternative methods of germinating seed and the general preparation of trees for budding are also being studied. The underlying aim of these attempts is to arrive at improved and accelerated procedures that will produce better results in the nursery.

Easily peeled citrus varieties

The citrus varieties that are easy to peel (naartjies and related crossings) are still given top priority. Trial consignments of fruit were exported to England this year. This is the first harvest of about 10 promising new cultivars in the Republic. The consumer requires fruit that is attractive, tasty, easy to peel and contains few or no seeds. From the producer's point of view the tree should bear a good crop and the fruit should travel well.

It is no easy task to combine all these requirements in one cultivar for the early market, another that ripens a little later and even a third for the late market. Although no comments have

been received from the marketing agents, preliminary observations seem to indicate that this ideal may not be impossible to realise.

The re-planting problem

A highly scientific approach to the replanting problem has been adopted. Certain organic toxins that may play a part have already been identified. A considerable amount of additional basic work is still necessary to get a better insight into the nature of the problem. Further investigation of the phenomenon is expected to produce possible solutions.

The brack problem

Horticultural methods of enabling farmers to cope with brackish water and brackish soil are being investigated. Progress has been made in finding methods of evaluating the tolerance of unknown crossings, used as rootstocks, to brack salts such as those found in the Sundays River at present. Activities are still at the initial stage but seem promising for the future.

Diseases and pests

Citrus nematode

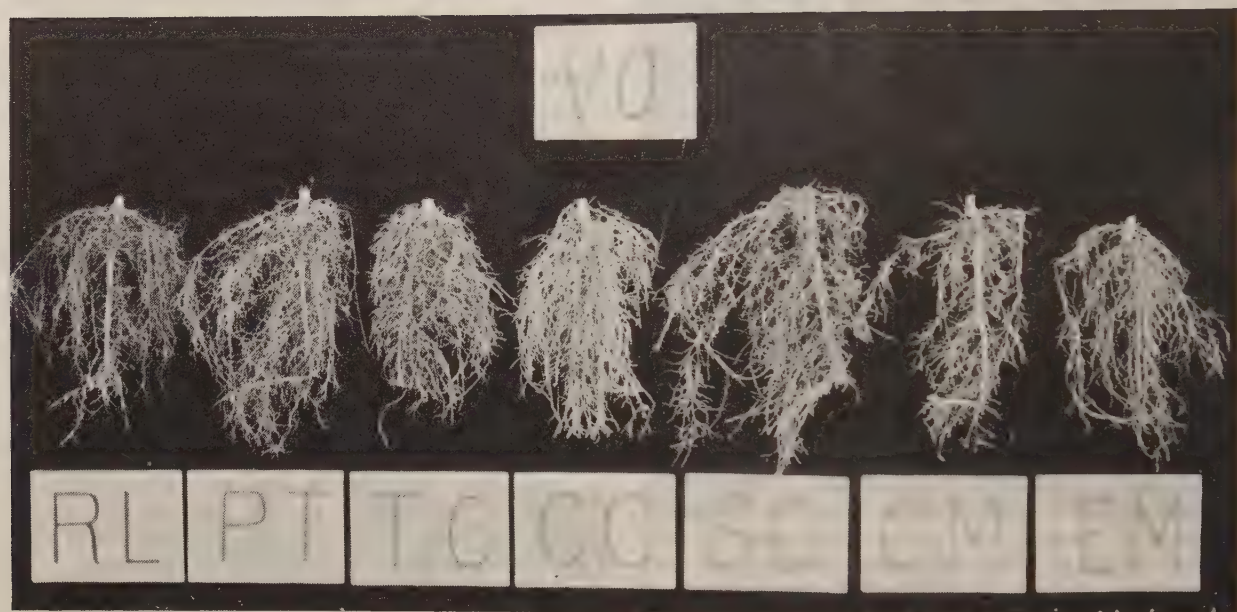
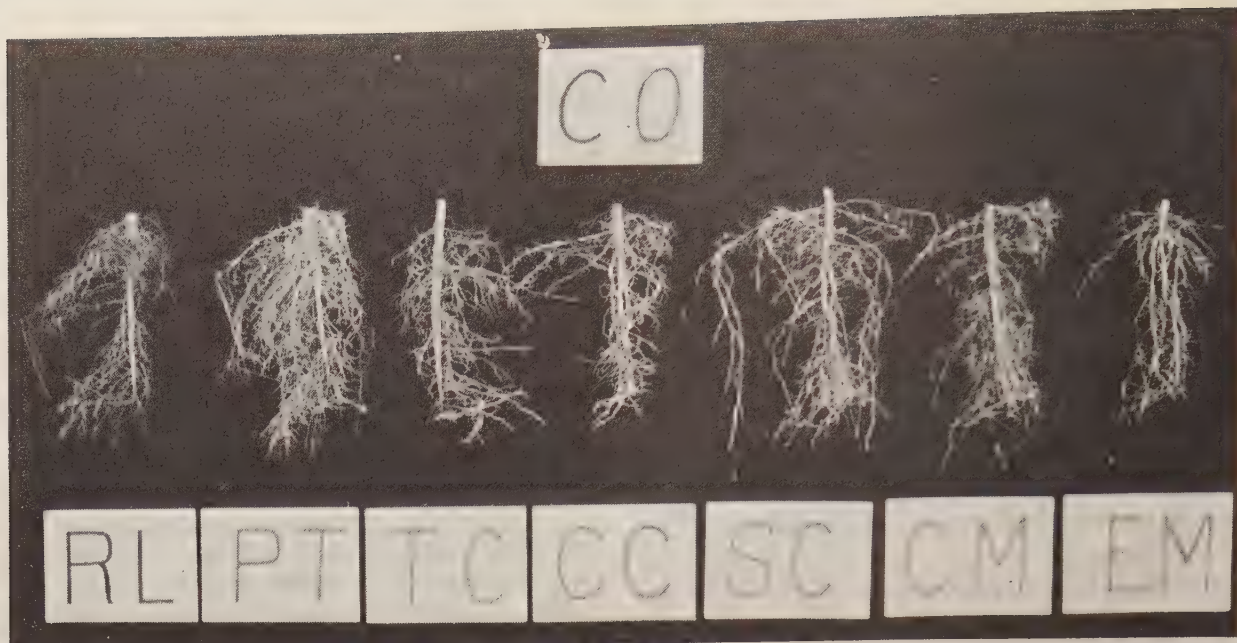
In an experiment to control citrus nematode *Tylenchulus semipenetrans* phenamiphos was applied to 7-year-old Valencia trees, using flood irrigation. The chemical was applied at 40 kg/ha, using the emulsifiable concentrate formulation. The results show that the nematode population is dramatically decreased in the first year after treatment, after which it slowly returns to higher levels over a 3-year period. Yield increases were obtained for all 3 years following treatment, but were significant only in the first year. Treatment tended to increase the uptake of macro-elements and to decrease the uptake of micro-elements.

A further nematocide trial with phenamiphos, in which it was applied via the microjet irrigation system, has now shown effective suppression of the nematode population for a period of two years.

A series of laboratory trials were conducted in an effort to establish the dosage of phenamiphos required to kill nematodes in irrigation water. With good aeration of the water, 600 to 800 ppm are required, but if the water is allowed to stand, causing a relative lack of oxygen, 400 ppm is sufficient to give 100 % kill.

Citrus psylla

Further trials with dimethoate used as a soil application via the microjet irrigation system have shown that this chemical not only controls psylla and aphids, but also suppresses red scale to such an extent that it is not an economic problem. White waxy scale was also controlled when this chemical was applied when crawlers were active. The adult stages of waxy scale was controlled by natural enemies.



These two photos illustrate the differences in root development of a number of important citrus rootstocks on old citrus lands (CO) and on field soil (VO). RL indicates rough-skin lemon, PT *Poncirus trifoliata*, TC Troyer citrange, CC Carizzo citrange, SC Swingle citrumello, CM Cleopatra mandarin and EM Empress mandarin

Citrus thrips

Scanning electron microscope studies of the mouthparts of the South African citrus thrips *Scirtothrips aurantii* have shown that there is a well-developed mandibular stylet capable of puncturing cell walls. In addition there are paired maxillary stylets which can extend approximately $20\ \mu$, allowing for penetration into leaf palisade cells. This seems to indicate that citrus thrips is a potential vector of virus diseases.

Control of the false codling moth

A successful laboratory technique for the large-scale breeding of the indigenous egg parasite *Trichogrammatoidea lutea* a Girault has been developed. The eggs of the false codling moth *Cryptophlebia leucotreta* Meyr., again bred artificially, are used.

In a trial with navel oranges to try to improve the biological control of false codling moth, laboratory-produced parasites (*T. lutea*) were



A plastic tunnel in a citrus nursery

released. Weekly releases for the duration of the season, amounting to 382 000 parasites per acre, produced a decrease of 50 % in the total fruit loss. A programme was started with the aim of breeding a more resistant race of *T. lutea*, from the Sundays River Valley, for release in the citrus orchards of the Citrusdal Valley, where false codling moth caused considerable damage during the past season.

Screening of pesticides

Eight relatively new insecticides have been screened to determine whether they cause a detrimental increase in the numbers of any citrus pests. Such increases are usually associated with a destruction of the natural enemies of the pests involved. Tetrachlorvinphos and one of the new pyrethroids caused a serious increase in red scale numbers, and there were indications of an increase in citrus red mite populations. Quite inadvertently it was found that although the soil application of dimethoate for the control of citrus psylla was not phytotoxic, the application of herbicides (bromacil plus diuron) a few weeks earlier resulted in severe phytotoxicity and a loss of 62 % of the navel crop. These two treatments obviously require to be well spaced.

Biological control of red scale

Detailed recommendations have been published for an integrated pest management programme for citrus, with red scale under permanent biological control. The Citrus and Subtropical Fruit Research Institute now applies this programme to all its citrus plantings on seven experimental farms throughout the country.

Experiments on the control of resistant red scale were carried out in the Letaba area, where red scale in two experimental plots was finally brought under biological control without the application of sprays during 1977/78. It is considered that the biological control of red scale is a very promising solution to the resistant red scale problem, which arose from the indiscriminate use of organophosphate insecticides.

Pathological aspects

Further research into greening treatment was aimed largely at the mechanics of injection and streamlining the technique. Very promising results were obtained with low volumes of high concentrations of tetracycline, whether injected under high or low pressure.

The collection of potential mild strains of tristeza to be used for cross protection against severe strains of the disease continued and the

selection of the most promising of these strains should begin within the next season.

Indexing for the Citrus Improvement Programme (CIP). All the candidate trees have now been indexed for exocortis and this gave rise to the interesting finding that about 20% of our citrus is infected with this disease. Indexing for xyloporosis and impietratura has begun.

PINEAPPLES

Nematodes

A survey of the plant-parasitic nematodes in the major production areas of the Eastern Cape, Zululand and the Northern Transvaal has shown that over 33 different species of nematodes are associated with pineapple plants in the Republic. Of these species, *Meloidogyne javanica*, *Pratylenchus brachyurus* and nematodes belonging to the genera *Scutellonema*, *Helicotylenchus* and *Rotylenchus* were the most common in root and soil samples.

Pot trials conducted under glasshouse conditions indicated that *M. javanica* and *P. brachyurus* could cause significant damage to the growth of Smooth Cayenne pineapples. Spiral nematodes, however, appeared to have little effect on plant growth.

Evaluation of foliar sprays of the systemic nematocides phenamiphos and oxamyl have shown that these products are effective in suppressing nematode build-up in pineapples, especially if used in conjunction with a preplanting soil fumigant treatment. Nematocide screening trials are being conducted to evaluate newer nematocidal materials and nematocidal formulations on pineapples.

The monitoring of nematode populations in plots planted to various grass types and legumes has indicated that *Chloris gayana* var. Katambora and *Desmodium intortum* are effective in reducing nematode populations in the soil after a cycle of pineapple.

Plant selection

Canning tests have been carried out on four Smooth Cayenne clones developed at the Agricultural Research Station, East London. These tests have shown that, owing to the improved shape of the clone fruit, the number of rings per fruit could be increased by 20% over that of field run plants. Further, these clones exhibited a greatly reduced occurrence of undesirable features such as multiple topping, spiny plants and poorly shaped fruit.

A Queen selection has been developed which produces a fruit with a higher mass than the local Queen cultivar. A disadvantage with the Queen selection is that it takes longer for the plants to bear their plant crop than the local selection.

Plant propagation

Two trials have been conducted with the chemical chlorflurenol and the results indicate that

the application of this product after flower induction in winter is not as critical as it is in summer.

Herbicides

A large number of different herbicides have been evaluated for the control of the grasses *Panicum* spp. and *Paspalum* spp. From these evaluations, four herbicides have been selected for further investigation.

Experimental results and observations have underlined the fact that poor soil preparation is a major cause of poor weed control in pineapple lands. Many of the severe infestations of *Paspalum* can be attributed to large amounts of root material being left in the soil after a land has been prepared. This material is easily capable of producing a mature, seed-producing plant a short time after the first spring rains. None of the herbicides tested to date are capable of killing or preventing the growth and development of this root material.

The effect of poor weed control on the growth and plant crop yield of pineapple plants, together with the related economic implications, were studied.

Fertilising

The investigation into the influence of varying amounts of nitrogen and varying amounts and forms of potassium and magnesium on the growth and yield of pineapple plants was continued. Results have shown that the correct ratio of N and K, based on a preplanting soil analysis, is essential for obtaining optimum yields. The correct levels of N and K promoted rapid growth, healthy plants yielding fruit of a desirable size and plants with the required number of suckers. In the case of deficient or excessive quantities of N and K being applied, smaller fruit, undesirable numbers of suckers and delayed fruiting resulted.

The effect of magnesium in the form of magnesium sulphate and magnesium oxide is being evaluated. Visual observations to date indicate that magnesium oxide produces a far better leaf colour and plant growth than magnesium sulphate. Increasing levels of nitrogen, from 300 kg of N to 900 kg of N/ha, were applied to Smooth Cayenne plants in order to determine the effect of these treatments on the nitrate content of the fruit at harvesting.

Growth regulators

The effect of varying intervals between initial applications of ANA, BOH and ethephon and follow-up applications of ANA in order to improve flower induction and fruit yield is being studied. Initial results indicate that the percentage of induced plants and fruit yields can be improved by increasing the interval between the first and second applications. A disadvantage of increasing the

interval between flower induction applications is that the harvesting period is extended.

Researchers are working on a guide to the correct stage for flower induction to enable plants to produce fruit of an acceptable mass and size. It would appear that a Smooth Cayenne plant with a mass of 1,5 kg should be capable of producing a plant crop fruit with a mass of 1,75 to 2,0 kg.

Various growth regulants are being evaluated for their efficacy in increasing mass and size.

Pineapple plants grown under different plant nutrient régimes will be induced to flower in order to determine the influence of the nutritional status of the plant on its ability to respond to flower induction.

Phenology

Preliminary results indicate that the observed differences in pineapple plant growth and development between East London and Bathurst are related to differences in soil temperatures. Some evidence of climatic effect on the natural differentiation of pineapple plants has also been obtained.

Pests

Mealybug

In a trial carried out at East London, a moderate mealybug infestation of Smooth Cayenne pineapples during the growth and development of the plant crop resulted in an 11 % reduction in fruit yield and a 120 % increase in the number of black spots per fruit.

In order to obtain 75 % control of ants and so reinforce the effect of natural enemies, it was found necessary to apply HHDN to the soil at a dosage

of 6 kg 36 % WP per hectare. Ant control alone was not found to produce an acceptable degree of mealybug control and it was necessary to treat infested planting material with methyl bromide, mercaptothion or diazinon or to spray established plants with mercaptothion or diazinon.

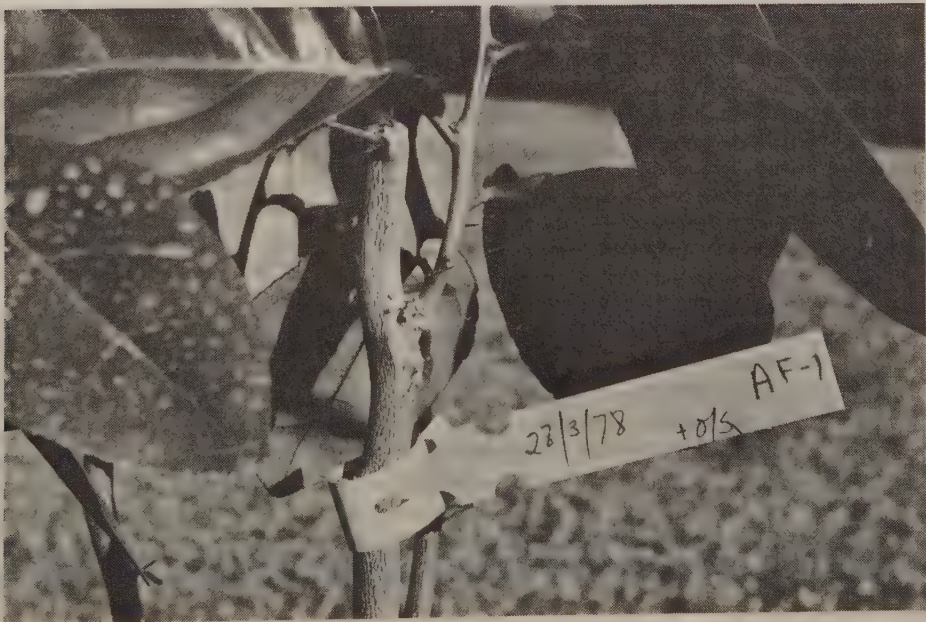
Mites

It has been found that populations of the mite *Steneotarsonemus ananas* generally increase in number on the leaves from planting until shortly after flower differentiation, and then rapidly decline. The association of this mite species with the occurrence of leathery pocket and the relationship between mite numbers at different stages of plant development and the incidence of leathery pocket in the fruit is to be investigated. In an extensive survey of the pineapple producing areas of the Eastern Cape an attempt is to be made to identify other factors which might play a contributory role in the development of leathery pocket.

Acaricide screening trials have proved that endosulfan is still the most effective chemical for *S. ananas* control. Two other preparations which provided good control are fenbutatin and cypermethrin. Endosulfan is applied alone, and in combination with fungicides to pineapple plants under field conditions in an attempt to control leathery pocket. Experimental results have indicated that leathery pocket control measures should be applied very close to flowering in order to be effective.

White grub

Of a large number of soil insecticides evaluated, only HHDN and dieldrin gave adequate



Growth-point grafting plant grafted on existing seedlings in a glass-house to stimulate vegetative growth

control of white grub for a two-year test period. The insecticide isazophos gave excellent control of white grub for eighteen months and carbofuran for about twelve months. An extensive field trial is being conducted with isazophos.

The insecticide isazophos at the dosage of 5 kg ai/ha has shown a high degree of activity against soil pests of pineapples when applied as a high volume, topical soil spray. Other insecticides such as dieldrin have not exhibited this property.

Nematocides

Treatment of pineapple plants with a foliar spray of phenamiphos was found to induce an inhibition of the polyphenoloxidase enzymes and two iso-enzymes in the roots of the plants. It therefore appears possible that in addition to direct nematocidal effects, phenamiphos is in some way interfering with the host parasite reaction in the roots of the pineapple plants. In addition, this reaction may elucidate the apparent basipetal movement of this pesticide in plants, in which nematodes remaining in the rhizosphere are unaffected by foliar applications.

This may also explain apparent growth stimulation which has been observed following phenamiphos application to pineapples, even when not associated with nematode control.

SUBTROPICAL FRUIT

BANANAS

Cultural aspects

Despite the extremely favourable weather experienced during the past season, the production of bananas was once again lower than anticipated, which resulted in excellent prices for the producer. The cause of the decline in production is unknown and this aspect is being investigated. The high prices received by the grower have sparked off an interest in banana growing and the area under production is expected to increase considerably. The new plantings consist largely of the Williams banana, because trials have shown that it is decidedly superior to the Dwarf Cavendish. Not only does the Williams produce heavier bunches with larger fruit, but it also appears to have a shorter bunch to bunch cycle. The "Americani" banana imported from Réunion is still in quarantine.

Pests

A new insecticide, triazophos, has been registered for use for the control of the banana silvering thrips, *Hercinothrips bicinctus*. The thrips are present wherever bananas are grown commercially, and are present from July to February in pest populations. The blemish caused by the thrips is a silvering blemish of the fruit. Triazophos should be applied to all bunches, using a knapsack sprayer, so that all the fingers of a bunch are thoroughly drenched.

Triazophos should be applied at 85 ml per 100 litres of water. Bunches that are to be harvested within seven days should not be treated. In severe infestations treatment every six weeks is required, but during mild infestations, a single application may be effective for up to twelve weeks.

Triazophos also provides limited control of cotton mite *Tetranychus lombardini*, which induces a similar blemish to that produced by thrips. In severe infestations dicofol at 100 ml per 100 l should be applied. The problem period for these two pests overlaps, so that a combined application of the two chemicals would have been desirable. But when the two chemicals were applied in a combined treatment, young bunches were burnt. Fortunately mites are only a problem on mature fruit, so a combined spray can be applied on such fruit as long as triazophos is applied separately to all young bunches.

A survey of the plant-parasitic nematodes present in banana roots and adjacent soil has been completed. Sixteen species of nematodes have been identified, nine of which are new records for nematodes on bananas in South Africa. In addition, this survey showed that the quarantine scheme introduced to half the spread of *Radopholus similis* has worked successfully in the Transvaal in that no new infestations have been detected. New infestations are still being recorded in Natal, owing to the build-up of old undetected infestations and the natural spread of the pest.

Changes in the population structure of *Helicotylenchus multicinctus* at three sites showed that a yearly cycle of population structure is related to temperature. With the onset of warmer temperatures in spring, an increasing percentage of adult nematodes occurred, indicating that nematode development and reproduction had increased, but the resultant increase in overall numbers of nematodes followed only after a two-month lag. A reverse cycle occurred with decreasing temperatures. On a sandy soil, high summer rainfall resulted in an immediate decline in nematode numbers. These results will play an important part in assessing the optimum timing of any control procedures.

Experiments with various granular and fumigant nematocides are in progress and results so far obtained show that on light soils the control of banana nematodes leads to an increased growth rate and plant size. On heavier soils, promising results in terms of control of nematodes have been obtained, but there is as yet no indication whether a similar yield response will follow.

Storage

The effect of orchard cold damage on the ripening and general quality of bananas was investigated. The results show that bananas showing slight cold damage symptoms ripened normally and that the mild symptoms even disappeared from the fruit during ripening. However fruit showing slightly more severe

symptoms of cold damage ripened more slowly and had a poorer colour. Fruit that was badly damaged did not ripen at all.

The influence of sunburn on the ripening of bananas was also investigated. It was found that sunburnt fruit was unacceptable for marketing in spite of the fact that sunburn was confined to the peel.

Investigations were carried out to determine at what temperature in the immersion tank bananas start to "burn". The results of this investigation showed that fruit was damaged only at temperatures over 45 °C, if left in the hot water for as long as 30 minutes. The hotter the water the sooner the fruit showed signs of burning.

The influence of hot fungicide treatments on the keeping quality of bananas was also determined. The results, although disappointing, nevertheless showed that post-harvest spoilage can be controlled more effectively if the post-harvest fungicide treatment is applied hot.

During the past season attention was again paid to the hard core problem. Few fruit in which this problem was evident could be found and there is doubt whether the problem is in fact of economic importance.

A new banana ripening room, donated to the Institute by the Banana Control Board, was tested recently. It was found that the room will be eminently suitable for research because there is a very even flow of air through the stacks of bananas, resulting in little variation in fruit temperatures.

AVOCADOS

Cultural aspects

Of the new cultivars planted at Burgershall, Bacon, Teague and All Boyce produced fruit during the past season. The ripening times of the above-mentioned three cultivars were April, January and July respectively. The cultivar Teague appears promising for the domestic market, out of season. Little is known about resistance to diseases as yet.

Characteristics

Approximate length	± 90 mm
Approximate mass	± 255 g
Colour	light green
Appearance	smooth
Thickness of skin	0,25 mm
Texture of skin	thin and easy to remove
Thickness of flesh	30 mm
Diameter of stone	30 mm
Mass of stone	33,4 g
Flavour	nutty, semi-sweet
Stone	loose
Shape	oval to round

New cultivars that were imported during the year are Santana, Pinkerton, Sharwill and Horshim. G6 and Huntale were imported as rootstocks. All the cultivars are still under quarantine.

Research in connection with graft incompatibility is continuing and genetically identical rootstocks obtained by cutting the seed in two before planting are being used for further trials.

Pathological and virological aspects

Sunblotch, the only virus disease known to affect avocados, is a seedborne disease. It is therefore very important that all seed sources for nurseries be indexed. Vegetative indexing by means of indicator plants has been refined to the extent where reliable results can now be obtained within 9 months. All attempts at working out a biochemical method of indexing have failed, although tests on the effect of the disease on enzyme and phenol levels have been investigated.

It has been found that several techniques enhance the effect of chemotherapy aimed at controlling the disease. Both cutting back of the aerial parts of the tree and heavy liming have a synergism with chemical treatment. Three chemicals have shown distinct promise in controlling the disease.

We are now in possession of all the available rootstocks that are resistant to phytophthora and are propagating them firstly for testing with regard to their relative performance and secondly for distribution to the industry.

Storage

The technique of determining the picking ripeness of avocados by measuring the moisture content of the fruit was improved during the past season by using a microwave oven to dry the fruit. This method results in a considerable saving on costs and time and is accurate. It was found that an ordinary small domestic microwave oven can easily dry 18 avocado samples in 40 minutes - an average drying time of less than 3 minutes per sample.

MANGOES

Horticultural aspects

With regard to planting trends, expansion is still taking place in the mango industry. It is estimated that there will be about 1 000 000 trees in production by 1980. The mango processing industry is also expanding considerably. The production of mango chutney and the canning of mangoes are still increasing, and new products such as mango nectar and dried mango strips are receiving much attention and are already being produced on a commercial scale. The South African Mango Growers' Association is actively organising and co-ordinating mango marketing. Exports of mangoes increased during the past season by 300 %, reaching a record of 106 000 boxes. The biggest

problem is space - mangoes still have to be exported by air.

Mango pruning trials are giving good results, and the cultivar improvement programme produced promising selections. The imported cultivar, Tommy Atkins, is very popular and could possibly become one of the commercially recommended cultivars as soon as information on production and disease resistance is available.

Early fruit drop in most mango cultivars is one of the most important factors causing poor yields. An investigation showed that the combination of ethylene and the enzyme peroxidase plays an important part in causing fruit drop. It has now been established that by starting to spray the panicles with silver nitrate at an early stage the high activity of these factors is inhibited. A significant increase in fruit setting was obtained in the Haden cultivar, which normally produces a very small crop at Nelspruit.

Jelly seed in the fruit is a very important post-harvest problem in certain mango cultivars. It was also found that the cause of jelly seed is related to the maturity of the fruit and the stage of ripeness during harvesting. It can be prevented by regularly determining the ratio between the mass and volume of the fruit. It has now been determined that the Sensation cultivar must be harvested before the external fruit ripeness colour appears, i.e. before the mass/volume ratios reach an equal value.

Pathological aspects

Although several new chemicals were tested, no new treatment has emerged for controlling bacterial black spot.

Flower and vegetative malformation and proliferation caused by a *Fusarium* species is causing severe damage in certain areas. A series of trials using various fungicides, hormones and acaricides is being undertaken in an attempt to find a control programme.

Storage

A wide range of fungicides were tested in various trials for the control of post-harvest spoilage in mangoes. The best control was obtained by immersing the fruit in hot benomyl directly after harvesting. With this treatment post-harvest spoilage was reduced by about half. Where fruit was sprayed against post-harvest spoilage before harvesting, one treatment, namely spraying with copper oxychloride, also provided good control.

The effect of partial ripening before storage on the keeping quality of mangoes was also investigated. The results showed that artificial ripening before storage does improve the colour of the fruit, although the fruit subjected to this treatment also showed considerably more spoilage than the non-ripened control.

LITCHIS

Horticultural aspects

The litchi industry is a stable one and about 1 000 tons of fruit are produced annually. Many young trees were planted but are not yet in production. The export market is good, but is limited to a large extent by the short season. About 10 % of the local production is exported.

A study was undertaken to compare the growth and yield of trees bred from air layers with those of trees grafted onto a seedling rootstock. There is little difference in the aerial growth of the trees and because the trees are still young yield differences cannot yet be determined. More yield data have still to be gathered. The root systems differ considerably, however. The air layered trees have thick lateral roots (40-60 mm) in the top half metre of the soil. The root distribution from the stem attains a depth of 2 metres and a width of 1,5 metres. The feeder roots are very concentrated in the top half metre of the soil. Grafted trees have a taproot that grows 2,5 m deep and have thin lateral roots (15-20 mm thick) distributed over the whole length of the taproot and spreading up to 2 metres from the stem. The feeder roots are less concentrated in the top half metre of the soil.

Storage

Good results were obtained in the past in respect of the control of post-harvest spoilage in litchis by immersing the fruit in a hot mixture of dichloran and benomyl after harvesting. This work was rounded off during the past season by a trial in which the best mixture of these two fungicides was determined. The results of this investigation showed that a mixture of dicloran and benomyl in the ratio 3:5 gave the best results at a concentration of 1 000 ppm.

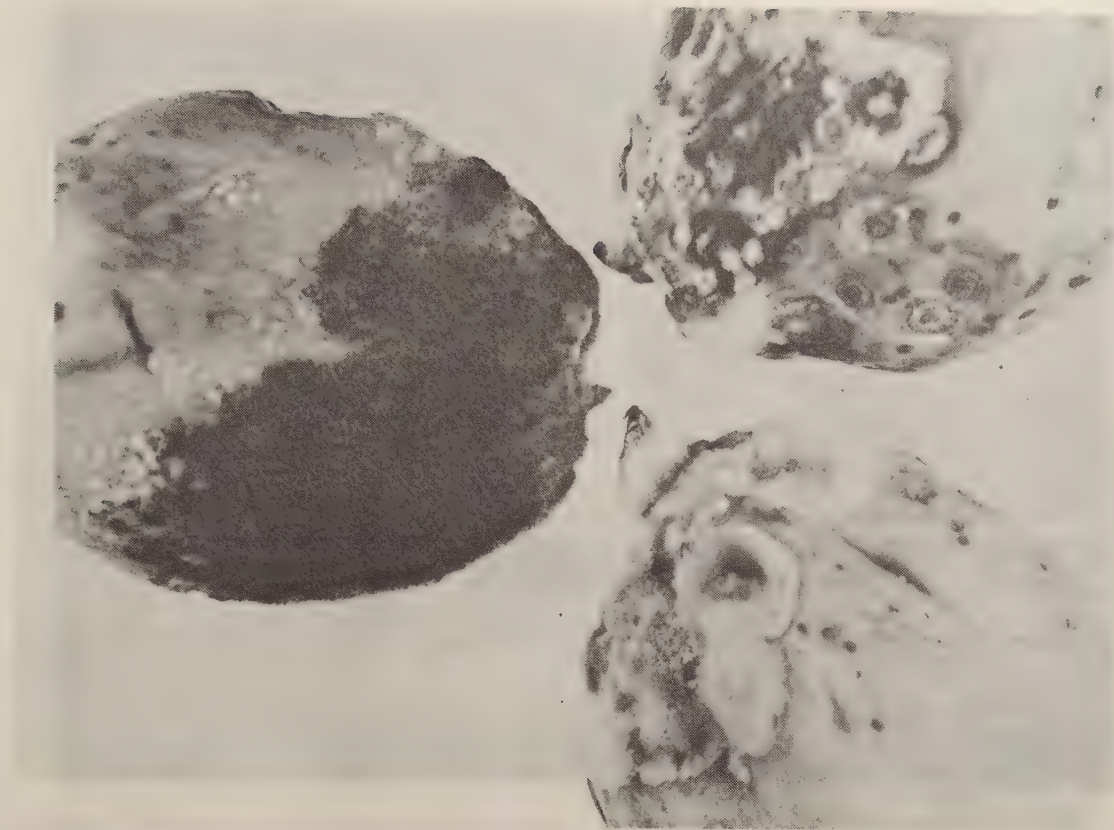
PAWPAWS

Horticultural aspects

The pawpaw industry, which has always been a stable one, showed an improvement during the past year as a result of the good prices obtained.

New research projects were started. Attempts will be made to breed a pawpaw which will be suitable for both the domestic and the export markets. A hermaphrodite (solo) pawpaw variety, namely Sunrise Solo, will be used for this purpose.

An isolation orchard of Sunrise Solo will be established on the Burgershall experimental farm to distribute true-to-type seed to growers. A female Solo orchard is being established on the Friedenheim experimental farm to determine the marketing potential. A breeding orchard, consisting of various selections of good pawpaw varieties from which suitable breeding material will be selected, has been established at Nelspruit. Good results have also been achieved with propagation by means of cuttings.



Pawpaws are very susceptible to spoilage when stored for any length of time, such as during sea transport. Promising trial results have been obtained with various remedies to prevent post-harvest rot, but no remedies have so far been registered

Storage

Commercially packed pawpaws were subjected to various fungicide treatments and stored under conditions to which the fruit would be exposed during export by sea. They were then examined for internal and external keeping quality. The results showed that good control of post-harvest spoilage can be obtained by immersing the fruit in hot dicloran before packaging. Spoilage was reduced from 76,6 % in the control sample to 13,4 % in the treated fruit.

GUAVAS

Horticultural aspects

During the past year producers showed even greater interest in the production of guavas. Plantings were enlarged and a considerable number of new plantings were established. Guavas are exported largely in the form of "guava pulp" as well as in the form of dried guava rolls. Fresh fruit was recently sent to London by air, where it fetched a very good price.

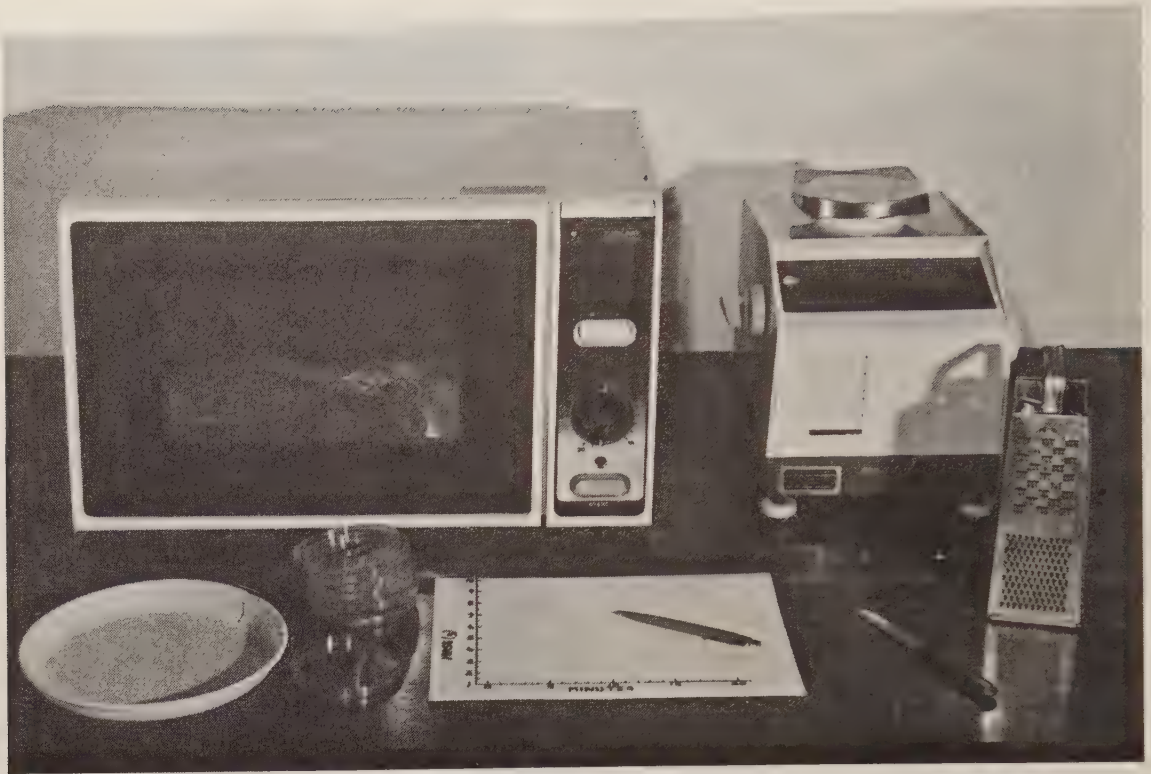
Research is now being carried out in an attempt to select fruit for specific uses, namely for pulping, drying, fresh consumption and canning.

Promising new cultivars were imported from abroad for comparison with existing cultivars.

A pruning trial after the first season's crop showed little difference between the systems of vase shaped, flat crown and severe pruning. Hedge pruning resulted in a higher yield, which can be attributed to the fact that twice as many trees were planted per trial plot. A trial to test various pruning times has been started; only at a later stage will it be possible to determine the effect of the pruning time on the yield.

Pests

In an attempt to find an alternative preparation for the control of banded white grub *Ferrisia virgata* (CKII.) in guavas various insecticides, as well as ant control with the aid of a sticky ant barrier around the stems, were tested and compared with mercaptothion (which is registered at present). The results showed that prothiophos, prothiophos plus 0,5 % light grade narrow range distillation fraction mineral oil and one per cent oil provided better control of white grub than mercaptothion. The one per cent oil, however, caused scorching, which led to leaf drop. (The shade temperature during treatment was 30 °C.) The ant barrier was not successful as a result of the



An ordinary house-hold micro-wave oven with which avocado moisture determinations can be done. The apparatus is relatively cheap and very suitable for producers and fruit inspectors to test avocados quickly for maturity

normal shedding of bark under stems which caused gaps in the ant barrier. Ants could therefore gain access to the white grub and hamper natural predators.

PECAN NUTS

The production of pecan nuts has increased and more than 300 tons of nuts are being produced annually. Trial consignments of nuts are being exported and prospects of establishing a good export market for pecan nuts seem promising.

The past season was characterised by high rainfall, high relative humidity and few hours of sunshine during December and January. The incidence of scab was therefore more widespread and the cultivar *Choctaw* in particular showed severe infection. Cultivar performance will therefore be given more attention in future to determine to what extent it will be possible to continue with scab-resistant cultivars. Should it be necessary to follow a spraying programme, it will be possible to plant cultivars such as *Wichita* and *Choctaw* together with those still showing sufficient resistance at present, namely *Barton* and *Desirable*.

MACADAMIA NUTS

The large plantings of macadamia nut trees have now started bearing and the total production already amounts to more than 50 tons of nuts per

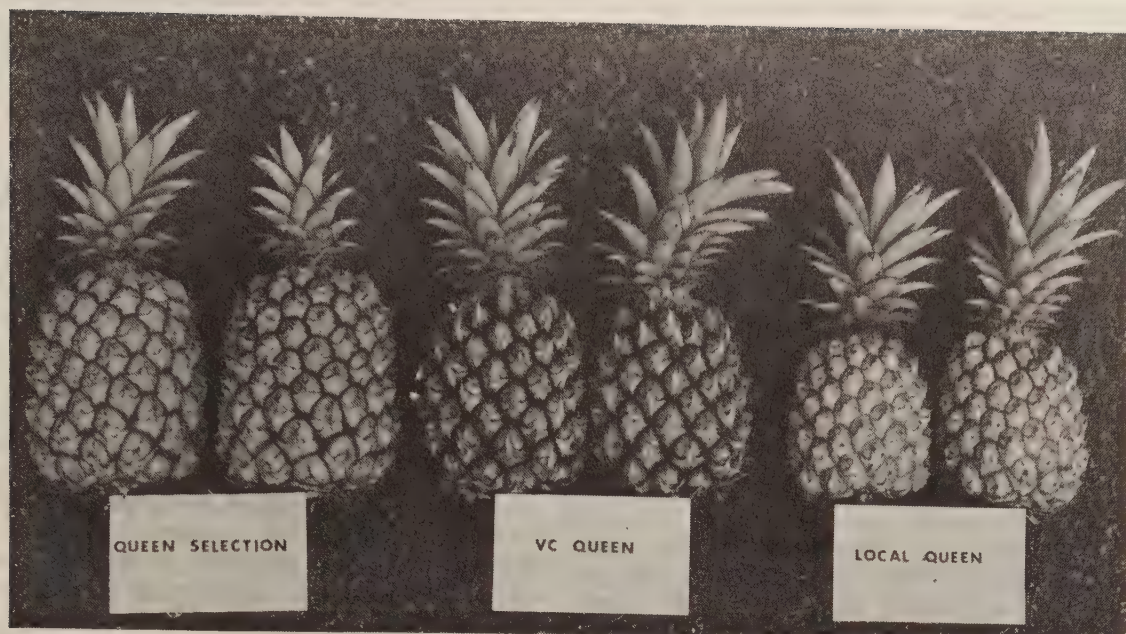
year. No large expansion of plantings is planned, but a yield increase is expected as the yields of the young trees increase. Cooperative organisations are at present undertaking trials in connection with the baking quality of the various cultivars and trial consignments are being exported. Since the results are being awaited no new cultivars were imported or released to the industry during the past year.

TEA

During the past season 4 000 tons of tea were harvested. The total area planted was 2 500 ha. To meet the local demand, 17 000 tons of tea is being imported at a price which increased during the past year to the present level of R1 500 per ton. This price makes tea production very profitable for the local industry.

Expansion of established tea estates is still taking place, but no new estates were started.

The new plantings consist mainly of vegetative material of clones producing high tea yields of a high quality. In the selection programme, 13 selections are at present being singled out for further testing to find the most suitable one for South African climatic conditions. An imported Japanese cultivar, *Benifuji*, was planted on a tea estate in the region that is subject to frost. There was frost during the past winter but the plants showed no damage. The leaves of the control plants did show a certain amount of burning.



A comparison in fruit size and shape between the Queen selection, the V.C. Queen and the local Queen pineapple

COFFEE

The South African crop amounts to 200 tons per year, and annual imports amount to 18 000 tons (of which 4 000 tons are high quality Arabica coffee and the rest low quality Robusta). During the past year the price per kilogram of imported green market coffee varied between R3 and R3,50 for Arabica. The current price is about R3,20 for Arabica and R2 for Robusta.

Many enquiries are still being received from farmers interested in planting coffee, but no large plantings have been started so far. In Venda a large coffee project is being started. An area of 200 ha has been prepared for a planting.

The cultivars Caturra, SL 28 and SL 34 are recommended. The cultivar Caturra produced a very promising yield during the past year and producers show great interest in including it as an additional cultivar when expanding the plantings. Seed has been made available for this purpose. The cultivars SL 28 and SL 34 were planted in the past.

Trials with new systemic and existing registered fungicides against coffee rust caused by *Hemilaea vastatrix* have revealed that these systemic fungicides can be used in a very much simpler control programme than is presently registered for this disease.

GRANADILLAS

Following another wet summer season the hectareage under granadillas decreased even further this past season. The main cause of the decline was foliar and stem-rot diseases. Unfortunately no reliable measures are yet available for controlling foliar diseases, which are hampering the industry.

The testing of hybrids from selected seed imported from Australia is continuing.

SPICES AND MEDICINAL PLANTS

The ability of a number of spices to become acclimatised was tested at Burgershall, Nelspruit and Kroondal. A large number of these plants grew very well, particularly at Burgershall. The other spices were renewed and a few, such as celery, spearmint, sweet basil, chillies, coriander and ginger, were singled out for more specific attention, particularly with regard to distillation for volatile oils.

The same applies with regard to medicinal plants and volatile oils. Fewer new medicinal plants were planted, however, than was the case with spices.

Oil distilled from lemon-scented grass is of a very high quality. Lemon-scented grass, *Leptospermum citatus*, sweet basil and vetiver were multiplied with a view to a more intensive distillation programme to determine the influence of factors such as climate, soil, fertilising, and harvesting time on the yield and quality of the oil. Dioscorea will also be studied as part of this project.

An anatomical study was made of the fruit development of bixa from the full flowering stages to the adult fruit (seed). The unmistakable influence of temperature on the rate of fruit development was noted. Bixa pruning trials were started at Levubu. A new planting of bixa was established at Nelspruit to determine the influence of pruning and the effect it has on the yield.

A number of ginger strains are being tested to compare production and quality. Turmeric was

planted to compare the yield after one year and two years of growth.

GINGER

Preliminary trials with the irradiation of mature ginger in order to reduce sprouting, and thereby prolong the marketing period, were successful. With dosages of 5 to 20 kilorad, sprouting was increasingly suppressed. Even 5 kilorad was sufficient to prevent sprouting of planted ginger. Shelf life was extended by at least 3 months.

FLOWERS AND ORNAMENTALS

Flower-producers, like producers in other sectors of the agricultural industry, have had to contend with a growing increase in production costs. Energy costs, in particular, have risen sharply. Most cut flowers in South Africa are produced in glasshouses which are heated and ventilated. With the increasing price of coal and oil in particular, these costs have become the flower farmer's greatest expense.

To cut down on these costs, there has been an intensified search for alternative methods of heating glasshouses. Solar energy is one of the principal methods being investigated as an inexpensive source of heating. One of the big chrysanthemum farmers has now erected an experimental glasshouse which is heated by solar energy. Conventional oil heating is used only as a back-up system. Although a number of shortcomings have been noticed in this particular system, it appears to be efficient enough so far. It was possible to rectify most of the defects by means of minor modifications.

According to the producer's calculations the system could effect a saving of up to 75 % in his oil consumption. From the interest shown by other flower farmers in the system it would appear that more of them will change over to solar energy.

BREEDING OF INDIGENOUS FLOWERING BULBS

Lachenalias

A method of multiplying lachenalia breeding strains rapidly by means of tissue culture has been developed. A promising yellow breeding strain which could possibly be released as a new cultivar was multiplied by means of tissue culture to about 3 000 small bulbs. The bulbs were tested for viruses and those that tested negative are now undergoing further multiplication.

Orchids

Cattleya and *Cymbidium* material was received for the determination of viruses and for

virus purification. An electron microscopic study revealed that the orchids were infected with tobacco mosaic virus (orchid race), *Cymbidium* mosaic and *Cymbidium* ringspot viruses.

Ornithogalums

In spite of their high commercial reproductive potential and beauty, ornithogalums are not cultivated on a large scale, as a result of the limited natural flowering period. By using different storage temperatures and combinations of temperature treatments, an attempt is being made to manipulate the flowering time in such a way that flowers can be obtained throughout the year and the bulbs prevented from sprouting before planting time.

By the application of a suitable temperature treatment, the period between planting and efflorescence can be shortened considerably, which will be useful in the commercial production of ornithogalums as cut flowers.

It is interesting to note that whereas flower initiation can be induced in other bulbs, such as tulips, by means of a cold treatment, it is induced in ornithogalums by means of a heat treatment.

The rapid multiplication of ornithogalum strains by means of tissue culture is being attempted in order to speed up the release of new cultivars. Virus purification of the material is also being attempted. Preliminary results show that it will be possible to work out a quick method of multiplying the strains. Some of the bulbs grown by this method have already been found to be virus-free and the industry can therefore be supplied with virus-purified material.

Nerines

The industry is experiencing difficulties at present with the production of nerines. The flowering of the bulbs is erratic because the flower buds in some bulbs dry out after initiation. The most suitable storage temperatures and methods of manipulation for improved flowering will be investigated during the coming season.

Chrysanthemums

Chrysanthemum cultivars undergoing virus purification at the request of the flower industry were studied. A number of the chrysanthemums contained chrysanthemum virus B and others chrysanthemum asparagus virus. The viruses were determined by means of indexing on susceptible plants and with the aid of the electron microscope.

Preliminary results show that clones of the cultivar Bronze Chip are likely to be infected with chrysanthemum dwarfing viroid.

Dahlias

Dahlias that are being purified of viruses at the request of the industry were also examined. Most of them were infected with dahlia mosaic virus.

FLOWERING POT PLANTS

Hypoestes aristata

Further research was carried out to determine the photoperiodic reactions of various selections of this indigenous South African species. A thorough knowledge of this aspect is essential for successful year-round commercial production. For example, it was found that the stock plants of some selections, when old, will form flowers even under conditions of continuous lighting. The lighter-coloured selections are especially sensitive in this regard. The regular renewal of stock plants used for cutting production is therefore necessary. A portion of each batch rooted can therefore conveniently be reserved for this purpose.

It was also found that even two or three short days of ten hours or less are sufficient to induce flower formation. During the natural short-day period of the year when the day length is less than twelve hours, it is therefore essential to provide extra lighting to extend the period of light during the time the cuttings are rooting to prevent too early flower formation.

With a day temperature of 25 °C and a night temperature of 15 °C, various selections will reach the full flowering stage in from 9 to 12 weeks after the commencement of short days of ten hours' duration.

Bougainvilleas

It was found that the best type of cutting for the production of pot plants is the tip cutting about 100 mm long. Cuttings taken from vigorously growing young plants which are beginning to harden slightly are very satisfactory. They root easily and will produce a marketable flowering plant in about five months, under protected cultivation, if the night temperature is not lower than 12 °C. Young rooted cuttings should never be overwatered, however, especially before new growth has started after potting.

It also became evident that some of the double cultivars which are now available are very suitable for pot plant production. Although they are not quite so easy to propagate, they do have one very distinct advantage. This is the characteristic of holding their flowers and bracts under household or office conditions of fluctuating temperatures without the application of a growth regulant spray. They will stay in perfect condition for at least four weeks or more.

Under the day length conditions prevailing at Roodeplaat some cultivars will flower all year round without special day length treatment, while others will flower more readily during the summer period of natural long days, if the day length is artificially shortened to 10 hours.

Pentas lanceolata

This species, which is indigenous to the tropical regions of Africa, has been found to have considerable potential as a flowering pot plant, in

addition to being an attractive bedding plant.

Colours ranging from white to pinks and reds are available and the plants are quite easily rooted from cuttings.

They respond well to some of the growth retarding substances and in the dwarfed form have attractive deep green leaves and numerous flower trusses. They will continue to flower for the greater part of the year if kept in a well lighted and warm position.

PROTEAS

During the past season the overseas demand for South African summer-flowering proteas was again far keener than the demand for winter flowers - the summer season for proteas lasted until Mother's Day. In October, in other words at the beginning of the summer season, pincushions *Leucospermum patersonii* and *L. cordifolium* were oversupplied on the overseas market for the second successive season, as a result of which buyers were more selective in respect of quality and placed more orders for particular products, such as particular selections.

It will be possible in future to avoid an oversupply of pincushions in October through practices such as the chemical manipulation of the flowering time by means of ethephon. Experimental results obtained during the past season showed that some *Leucospermum* clones are much more suitable for manipulation than others. The vigorous clones which produced long flower stalks performed particularly well during trials. In the coming season a selection programme for clones suitable for the late production of flowers in November and December with the aid of ethephon will be started.

As part of the extension campaign to promote the commercial production of proteas, a very successful farmers' day was held on the Tygerhoek Experimental Farm at Riviersonderend. There was keen interest in lectures and demonstrations on the manipulation of the flowering time of pincushions, vegetative propagation and improved seed propagation and in control of the rootrot fungus *Phytophthora cinnamomi*. Comprehensive pamphlets on the cultivation of *Protea cynaroides* and the bearded proteas were also published. In the case of *P. cynaroides* this coincided with the choice of this flower as the national flower of South Africa.

VEGETABLES

TOMATOES

The Transvaal, and especially the Northern Lowveld, suffered as a result of very heavy rains during the past year, which seriously hampered the establishment and performance of plantings. These conditions were an indirect advantage to researchers, in that they made much stricter evaluation possible.

Fresh market tomatoes (cultivars and breeding)

At three of the stations of the Horticultural Research Institute hundreds of breeding strains and cultivars were evaluated for resistance to bacterial wilt, general resistance to leaf diseases, yields, quality and resistance to bacterial canker and spotted wilt.

Good progress was made with breeding for resistance to bacterial wilt. Two breeding strains, Ld 2048 and L 2024, have a 100 % resistance under field conditions and their use in the breeding programme will be continued. A breeding strain which is virtually 100 % resistant under field conditions and has a much better fruit quality than the existing cultivars has been developed from a crossing between Ld 2048 and Heinz 1370. A breeding strain, R51/306, which compares favourably with H2990 in respect of resistance to bacterial canker, was developed. It is being retained as a gene source for the breeding programme. In addition, promising selections for nematode resistance were made from a crossing between Karino and Piersol VFN. This will fill a big gap because there is no commercial nematode-resistant cultivar for winter production available at present.

With regard to spotted wilt, resistant breeding strains were obtained. Most of these strains have one of the following as a parent: the wild tomato *Lycopersicon peruvianum* or Rey de Los Temporanos or the Hawaiian breeding strain Y1. The progeny of the latter bear particularly firm fruit with an acceptable fruit quality and are now undergoing further evaluation. These strains, which bear the number E174/309-1, are already in the seventh generation. Spotted wilt is a serious problem in the Western Cape and is increasing in the Eastern and Northern Cape.

During the year under review no new local or overseas cultivars were really outstanding and the situation in respect of available cultivars remains the same as the previous year. Evaluation of promising new cultivars and breeding strains is continuing on a national level.

Factory tomatoes

The canning industry experienced a major setback during the past year as a result of a reduction in the demand for tomato paste brought about by poor catches of fish. The breeding programme is, however, continuing, as is the evaluation of both existing and new breeding strains and promising cultivars from abroad. An important objective is to find cultivars with a high yield, resistance to diseases and sunburn, a high solids content, good colour, a concentrated crop, keeping quality on the plant and the ability to travel well. *Lesser known* cultivars which became prominent in the most important production regions are UC 82, UC 134, VF 134-1, Castlong and Mecheast.

Protected cultivation

Research on this production technique was continued at Roodeplaat and Elsenburg. The biggest problem at Elsenburg is the low winter temperatures, spotted wilt and a variety of fungus diseases which are serious inhibiting factors under the wet winter conditions. Yields and fruit size during the autumn and winter months are totally unsatisfactory.

Unfavourable low night temperatures are the most important inhibiting factor in the Transvaal Middleveld and Highveld and other regions in the interior. At Roodeplaat, in particular, attempts were made to overcome this problem. The soil was heated by means of electric cables and thermal screens - the latter to limit the radiation of the day's heat.

Although the cables effectively maintained the soil temperature at an average of 10 °C higher than the control to a depth of 200 mm during the two coldest months, they had no influence on the ambient temperature. The plants did not grow any better in the heated soil. Earliness, fruit size, the percentage of hollow fruit and the marketable yield were no better than in the control. The cost of soil heating for a 9 x 30 m tunnel amounted to R68 per month. Judging by these results, soil heating serves no purpose and is not justified.

Where thermal screens were used the plants made a better showing with regard to curled and scorched leaves than either the control or plants grown with electric cables. The fruit started ripening five days later than the control, but in respect of fruit size, hollow fruit and percentage marketable yield was equal to fruit grown with the other treatments. The work is being continued to determine the effect of the thermal screens on the production of marketable fruit during winter.

The most important result, however, is that neither the screens nor the soil heating could so alter the night temperature that normal production could be obtained. In spite of the beneficial effect of the thermal screens the temperature still dropped too low.

Diseases

In the autumn of 1978 a new disease was observed on tomatoes cultivated in plastic tunnels, it caused brown to greyish-brown stains on the leaves but did not affect the stems or the fruit. The disease was diagnosed as *Stemphylium* leaf spot. The fungus that causes the disease was identified by the Plant Protection Research Institute as *Stemphylium lycopersici* (Enjoji) Yamamoto. It is the first time that this fungus has been found in South Africa. The disease must be regarded as a risk factor in the cultivation of tomatoes in tunnels.

Verticillium wilt, caused by *Verticillium dahliae*, reached serious proportions on tomatoes cultivated in lands in the Lydenburg district. In the Transvaal Lowveld more attention will have to be paid to resistance to *Verticillium* wilt in the choice of cultivars.

Over 100 plant samples were received from producers and examined, and more than 80 % were found to be infected with viruses. It was possible to identify tobacco mosaic virus, spotted wilt and potato Y virus by means of the electron microscope.

ONIONS

After tomatoes, onions have the biggest turnover on the domestic market and are the most important export vegetable. The gross annual value to the producer amounts to about R13 million. The most important cultivation problems have already been solved and researchers are now concentrating mainly on breeding. Breeding and selection for an early, firm, round onion, the improvement of the existing Caledon Globe and Australian Brown and the development of a white cultivar for dehydration that has a high solids content and is adapted throughout the country are being continued. Resistance to *Fusarium* is very important in the case of Caledon Globe.

With regard to the early, round varieties, three breeding strains deserve special mention, namely an early Hojem selection, an inbred strain from Creole and the breeding strain 117-4-4-3-3-8.

Producers are still dependent on the cultivar Pyramid for the production of onions according to the onion set method. Where producers want to seed very early, direct on the land, in the summer rainfall region, Pyramid, early Hojem and Granex 33 perform best.

Good gene material is available for the dehydration of onions, but all the cultivars are extremely poorly adapted in the Transvaal production regions. In the Western Cape cultivars such as White Creole and Dehydrator 4, which were sown in April, and Dehyso and Dehydrator 14, which were sown on 15 May, performed well. These four cultivars also have very good dehydration qualities.

A late Australian cultivar, Pukekohe, gave excellent production and storage results at Elsenburg and Addo. Selection from and purification of the cultivar are being continued.

GARLIC

A fungus which causes numerous small black specks on the external leaves of garlic bulbs was identified by the Plant Protection Research Institute as *Embellisia allii* (Campanile) Simmons. It is the first time that the disease, which is mainly a storage disease, has been diagnosed in South Africa. The disease does not seem likely to be of economic importance.

White bulbrot was diagnosed for the first time in South Africa on garlic in the Transvaal. The pathogen was identified as a *Sclerotium* sp. which shows a morphological correspondence to *Sclerotium cepivorum*. Owing to the absence of the sexual stage, the identity of the species could not be confirmed. The bulbs of the plants were severely

infected and it was clear that the disease is as much a threat to garlic as it is to onions.

GREEN BEANS

The domestic fresh market is reasonably stable, and exports of fresh green beans increased considerably. For instance, 29 700 containers of green beans were exported during the first three months of 1978, which is 28 % more than in the corresponding period during the previous year. The canning industry, on the other hand, experienced a slump and the export market for processed products reached a low point.

Breeding

This programme was continued during the past year with the general object of increasing yields and improving resistance to disease, acceptability for the fresh market (domestic and export) and suitability for processing (freezing and dehydration in particular) and mechanical harvesting.

Various new promising selections and breeding strains are at different stages of development. Seed from various breeding strains was multiplied for final evaluation, particularly in respect of yield.

Of the breeding strains already included in the evaluation trials, selections of the breeding strain 265/61, especially 265/61-3, performed reasonably well at Roodeplaat. The seed is white and the plants have a satisfactory resistance to bacterial blight. The pods are straight, with an attractive appearance and good keeping quality, round, of medium length and thin (pencil thickness), which makes them suitable for exporting fresh as well as for freezing whole. In yield trials, however, cultivars with large pods such as Seminole and Thor produced significantly better yields. Further attention is being given to the evaluation of the 265/61 strains.

In the Western Cape halo blight *Pseudomonas phaseolicola* is becoming an increasing problem. Sources of resistance were sought in trials; some sources were found but the results varied. The possible existence of different races of the disease is at present being investigated, although preliminary tests indicate that the problem may be race 2 of halo blight.

Cultivars

The dwarf bean cultivars Seminole, Wintergreen, Contender, Top Crop and Thor are used for fresh market production, whereas Gallatin 50 and Harvester are still the most suitable cultivars for processing, although each has several drawbacks. Witsa, Lazy Housewife and Kentucky Wonder are still the best runner bean cultivars.

Various new cultivars, such as Cape, Torrent, Lake Shasta and Chicobel, were obtained. They are at present being evaluated throughout the country

and some of them are also being tested by the industry.

MUSKMELONS

Breeding

Interest in growing muskmelons for export has spread from the Western Cape to the Eastern Cape and the Far Northern Transvaal. A breeding programme is under way at Elsenburg with the purpose of improving existing cultivars and developing new ones suitable for export, mainly by sea, and likely to prove popular with European consumers. Cultivars of this kind would be particularly valuable in the Western and Eastern Cape, where the production areas are situated close to large harbours.

A small hard-skinned breeding strain for export by sea and three breeding strains for export by air were selected. These selections appear especially promising and will be evaluated in the coming season.

Cultivation

The biggest problem in the cultivation of muskmelons is the disease downy mildew *Pseudoperonospora cubensis*. It occurs throughout the country. Experimental results and observations confirm that the disease depends on humid conditions and that spraying is not very effective under unfavourable conditions. Preventive sprayings are essential.

The disease occurred throughout the country during the past year and damage in the form of poor quality and sunburn resulted from defoliation.

Good results were obtained in cultivar trials at Addo and Roodeplaat, where 24 cultivars were evaluated and all the necessary preventive measures applied. In both trials the cultivar Saticoy gave the best performance and produced yields of 13 tons and more per ha. Other cultivars that also produced good yields were Hales Best Jumbo, Noy Yellow and the other Hales Best varieties. These cultivars produced between 9 000 and 11 000 marketable melons per ha. Cultivars that gave very poor results at Roodeplaat were the Spanish and Portuguese hard-skinned varieties, and Honey Dew.

WATERMELONS

Fourteen recognised cultivars were evaluated at Roodeplaat during the past year. It was established that watermelons can be cultivated successfully on old lands where other vegetable crops have been cultivated for more than 30 years. All the cultivars grew very well and there was no incidence of *Fusarium* wilt. Yields varied from 17 to 50 tons per ha, comprising from 1 500 to 9 200 watermelons.

The best cultivars with regard to flavour, sugar content and resistance to leaf diseases were Sweet Meat, Congo and Sweet Princess. Under the prevailing conditions at Roodeplaat no significant differences between Sugar Baby and Sugar Doll

were found. The round fruit bred for chain stores were not as small as expected. The average fruit mass varied from 3,0 to 7,5 kg as opposed to 5,6 and 11,0 kg with Congo.

PUMPKINS

The breeding programme with pumpkins was continued with the purpose of, *inter alia*, improving the flesh colour and skin quality of the flat white Boer pumpkin. Undesirable green tissue under the skin is a problem at present but improvement is expected.

The selection and inbreeding of field-pumpkins to obtain uniformity and high quality in the most suitable shapes were continued.

Two *C. pepo* gem squash strains were imported and crossed with the locally bred Rolet to obtain increased resistance to powdery mildew and virus diseases. Unfortunately the cucurbit breeding programme was put back a year by the floods at Roodeplaat at the end of January 1978 which washed away the planting completely.

Diseases

Cucurbit material in which virus infection was suspected was again indexed for the type of virus. Cucumber mosaic virus has not been found in cucurbits in South Africa up to now. The viruses on all samples which were found to be infected were identified as watermelon mosaic virus.

CUCUMBERS

In the summer of 1977 brown rust was observed on cucumbers cultivated in a plastic tunnel. The disease was caused by a *Puccinia* sp. It is the first time that the disease was observed in South Africa and it is very unlikely that it will assume serious proportions.

CAULIFLOWER

Good progress has been made with the breeding programme for early and better midseason cultivars. Breeding strains with good head cover and quality are being purified and will be compared with standard cultivars as soon as sufficient seed is available. The biggest problems to be solved are the susceptibility to diseases and poor head cover of the existing early cultivars.

Promising overseas cultivars are being imported and tested under local conditions throughout the country. Three cultivars that have performed well so far at Roodeplaat, Elsenburg and in the Eastern Cape were tested during the past three years. Two of them, namely Igloo and Igea 65, have already shown good adaptation for several years. The third cultivar, Snowcrown, produced good yields at Roodeplaat. It is early and harvesting starts 55 days after planting and continues up to 75 days.

Igea 65 is an early midseason cultivar and harvesting starts 85 days after planting and lasts up to 115 days. The head cover and quality of Igea 65



The new sweet-potato Steenbok still looks good 4 months after harvesting

are slightly better than those of the other two cultivars.

The production of cauliflower seed in the Eastern Cape is being studied at Addo. Preliminary results indicate that this area is very suitable for the purpose.

SWEET POTATOES

Two new sweet potato cultivars, Steenbok and Ribbok, were released during the past year. Owing to its light red peel, Steenbok is really only to be recommended for the Transvaal. This sweet potato has a particularly attractive and uniform appearance and the flesh colour is white. The fruit develops in a bunch around the stem but does not lie as shallow as that of Impala. It is consequently less susceptible to sweet potato weevil infection.

Owing to its dull pink peel Ribbok is only recommended for the Cape Province. It is tasty and has an exceptionally good keeping quality. The sweet potatoes are borne in a bunch around the stem and the vine growth is reasonably vigorous.

The cultivar Impala is still giving excellent results in the Transvaal Middleveld and in the Free State, in spite of its comparatively weak vine growth.

The evaluation of cultivars and breeding lines being developed at Roodeplaat is continued in the other regions. In the Southern and Eastern Cape, Koedoe adapted better than any of the other cultivars. In the Free State it performed better with a relatively late planting than the others. This cultivar has a better keeping quality in the soil than the other cultivars. Ribbok produced exceptionally

good yields in the Eastern and Western Cape and there should be a good demand for it on those markets.

In trials at Glen basal shoots generally produced better yields than top shoots. The supply of shoots early in summer to producers in the Western Cape remains a problem. Attempts are now made to overwinter propagating material in the warm Olifants River area at Vredendal to supply farmers in the Boland.

Borrie, the most popular cultivar among consumers in the Western Cape, has now been purified of the most harmful viruses and will be evaluated during the next season.

In an attempt to determine how long a virus-purified sweet potato planting will remain virus-free if it is isolated from any sweet potatoes that may be infected, such a planting was left underground to overwinter. The new growth in spring was indexed for viruses and the results were negative. This indicates that, in the absence of vectors to transfer the viruses and of infected plants from which they can be transferred, virus-purified potatoes can be kept healthy for a reasonably long time.

GREEN PEAS

Late cold spells in the north and very wet conditions in the Cape South Coast region, accompanied by *Ascochyta* sp. and *Mycosphaerella pinodes* blight, did a lot of damage to the green pea industry. Consequently less peas for freezing, but 10 to 15 % more canning peas, were processed. In neither case could the demand be met. Summer

plantings on the Transvaal Highveld to increase production are also regularly affected by hail damage and weed problems.

Breeding was continued during the past year with the object of achieving higher yields, the desired quality characteristics and improved ability to adapt to South African climatic conditions. In addition to 28 new crossing combinations, more than 300 single plant selections were made from the previous crossing selections during the past year.

Nine crossing strains from crossings with so-called winterhardy parents are undergoing further testing for cold resistance of the plants, blossoms and pods.

An extensive breeding programme was started and reasonable progress has already been made with the breeding of a leafless, high-yielding cultivar capable of meeting the requirements for freezing peas and dry peas. Leafless plants have considerable advantages in that the absence of leaves should make them less susceptible to leaf diseases and blight as a result of the quicker drying of the plants and the soil. Other expected advantages are that the plants will have greater resistance to drought, will remain upright for longer because they are intertwined to a greater extent and are lighter, that the mechanical harvesting and threshing processes will be facilitated as a result of the absence of large quantities of foliage, that pod development will be more even and that cold damage should be reduced because more irradiation of the soil by the sun should increase heat radiation by night.

At the Outeniqua Experimental Farm, more intensive research was started in an attempt to find a solution to the serious blight problem in peas in the Southern Cape. In addition to the selection of plants for possible resistance, cultural practices and spraying with various fungicides are also being investigated. Investigations are also being carried out to determine whether the new leafless plants are, as is expected, less susceptible to this disease.

Yield and seeding time trials in the Free State again showed that late cold spells are the most important problem. If the correct seeding time for each cultivar is determined, yields equal to those in any other region can be obtained. It has been found that the popular cultivar Sprinter should be planted between 15 May and 1 June, Cape Freezer between 15 June and 15 July, Mars from 1 June to 15 June and Dark Skin Perfection between 15 and 30 June. Average yields of 2,5 and 3,5 ton of seeds per ha can be obtained.

DRY PEAS

As in the case of green peas, local production does not meet the demand for certain types, particularly yellow dry peas. Applications for permits to import 1 000 ton and more are received annually. The domestic farming income from dry peas increased gradually during the past few years to more than R2,3 million per year. Domestic and foreign dry pea cultivars are being evaluated and

used in crossings to develop more adaptable cultivars with a high production for South Africa. The imported dry pea cultivar Birte appears very promising.

With regard to seed peas, imports amounted to more than 1 000 ton per year during the past few years. During 1976/77 only 761 252 kg of seed peas was produced for which farmers received between R250 000 and R300 000.

ANCILLARY RESEARCH

Cherry plant improvement scheme

During the winter of 1977 virus-tested propagation material from the cherry experimental farm was again made available to approved nurserymen. A total of 41 000 buds of cherry cultivars and 360 rooted rootstocks were issued. The cherry plant improvement scheme has now been in operation for five years, but as a result of hail damage during the past season nurserymen were unable to meet the demand for certified trees for the cherry industry. Moreover, cherry producers are insisting to an increasing extent that the cherry trees be budded on the Mazzard hybrid Fb2/58/48.

Sweet potato plant improvement scheme

The number of virus-indexed sweet potato vines made available to nurserymen under the scheme this year increased by 35 %, to 361 000. The biggest demand was for Brondal, Impala and Steenbok.

To speed up the distribution of material for the scheme in the Western Cape, eight clones of sweet potato cultivars were multiplied for that area in the glasshouse at Roodeplaat during the winter. The material will be transplanted at Elsenburg in spring for multiplication and release to nurserymen.

Strawberry plant improvement scheme

The Horticultural Research Institute supplied 3 700 virus-tested daughter plants of the strawberry cultivars Selektta, Parfaite, Earlibelle and Tioga to A nurserymen under the scheme, for further multiplication.

When it is remembered that about 100 hectares of strawberries were planted to State-certified plant material in the summer rainfall area this year, it is clear that this scheme is having a widespread influence and that the industry has learned from experience the advantages of using certified plant material.

Chrysanthemums

At the request of chrysanthemum producers, six popular chrysanthemum cultivars that have deteriorated over the years as a result of virus infection were subjected to virus purification. By means of indexing, tissue culture and heat therapy techniques the phytosanitary status of the material was improved. About 100 cuttings of two cultivars

have already been supplied to the industry for further multiplication and production tests.

PLANT AND SEED CONTROL INSPECTION SERVICES

CONTROL OVER THE SEED TRADE

Regisration of sellers/cleaners of seed

Registered sellers and cleaners of seed now number 320 and 76, respectively, i.e. a total of 396 (as against 402 the previous year).

The registered sellers and cleaners of seed are distributed over the four provinces as follows:

	Transvaal	Cape	Natal	OFS	Total
Cleaners	37	23	7	9	76
Sellers	134	111	46	29	320
Total	171	134	53	38	396

Control over the cleansing and sale of seed

A total of 802 seed distribution points were visited. In all 1 686 inspections were carried out for the purposes of the Seeds Act. The number of seed samples taken for the testing of germination, physical purity, weed-seed content and/or variety purity and trueness was 2 315. The following table indicates the kinds which showed the most quality defects.

Defects	Kinds
Germination too low	Peppers, peas, sorghum, cotton, onions, garden beets, carrots, lucerne, garden beans, brinjals, white oats
Too much weed seed	Teff, rye grass, tall fescue, Italian rye grass
Variety trueness unsatisfactory	Cucurbits, brinjals, dwarf beans

Advertisements in magazines were investigated and 21 persons who were selling seed without being registered as sellers of seed were traced. Eleven different types of offence, of which the following are the most important, can be identified:

- (a) Selling seed that does not meet the prescribed requirements;
- (b) selling seed under false pretences;
- (c) selling seed in containers with incomplete marking or labelling of the prescribed information

Sealing lucerne seed

In terms of the regulations promulgated in Government Notice R.967 of 19 June 1970, 243 lucerne seed lots were submitted for approval and

sealing. Of these, 42 lots were turned down on account of the presence of dodder seed and other weed seeds.

The following quantities of lucerne seed were approved and sealed after being found to be free of dodder and to meet the requirements for purity and germination:

Place where approved	Mass of approved and sealed (kg)	
	1977/78	1976/77
Oudtshoorn/Ladismith	972 750	1 291 900
Uppington	77 550	50 240
Johannesburg	14 750	22 500
	1 065 050	1 364 640

The quantity of lucerne seed sealed was 22 per cent lower than during the previous year.

New legislation

Agroticum was declared to be "seed" in term of the Seeds Act, 1961, on 30 December 1977.

SEED CERTIFICATION

This function includes the administration and application of the following schemes which have as their object the production of seed of a high quality:

- (a) *The Basic Seed Scheme*, in terms of which basic seed for the production of certified seed is grown under the Seed Certification Scheme and the EOCD Scheme.
- (b) *The Seed Certification Scheme*, in terms of which variety-pure and variety-true seed of known origin is grown.
- (c) *The Export Seed Scheme*, in terms of which only basic seed supplied by overseas seed firms is multiplied in the Republic under official supervision
- (d) *The OECD Herbage and Oilseeds Scheme*, which is similar to the Seed Certification Scheme, but enjoys international recognition.

Quantities of seed certified

Table 1 (next page) indicates the mass (kg) of seed certified in terms of the various schemes.

The quantity of seed certified was 1 151 417 kg higher (all kinds) than the previous year. The production of field crop and pasture crop seed increased, whereas there was a reduction of 14,4 % in vegetable seed. The production of lupin seed (particularly for export) and cotton seed was 158 % and 98 % more, respectively.

The production of certified maize seed showed a further decrease as organisations started supervising the production of their private varieties themselves.

The production of certified dry bean seed expanded significantly. Of the 700 ha used for green bean seed production, 600 ha was planted for export purposes. In terms of areas planted, maize (approximately 18 000 ha), lupins (approximately

Crop group Table 1	Basic Seed Scheme	SA Seed Certification Scheme	Export Seed Scheme	OECD Herbage and Oilseeds Scheme	Total
Vegetables	26 568	1 158 563	156 862	-	1 341 993
Field crops	1 081 893	25 344 602*	-	2 532 187	28 958 682
Pastures	4 730	134 334	-	-	139 064
Total 1977/78	1 113 191	26 637 499	156 862	2 532 187	30 439 739
Total 1976/77	820 749	27 603 400	33 610	830 563	29 288 322
Total 1975/76	467 301	31 694 757	71 326	865 067	33 098 451

* of which 23 741 450 kg was maize seed.

9 000 ha) and cotton (approximately 2 700 ha) are the most important kinds cultivated under the certification schemes.

A striking characteristic of seed certification is that the quantity of seed cultivated under the OECD schemes increased from about 800 000 kg the previous year to approximately 2 500 000 kg.

As a result of favourable growing conditions, the quality of the seed was general satisfactory.

Participation in schemes

The following table indicates the number of inspections carried out and the total area inspected per crop group.

Crop group	Number of inspections	Total area inspected and approved (ha)
Vegetables	1 209	2 040
Field crops (excluding maize)	485	12 275
Hybrid maize: White and yellow	3 483	17 991
Pasture crops	93	673
Total 1977/78	5 270	32 979
Total 1976/77	7 268	34 285

In all 31 merchants and co-operatives and 689 nurserymen participated in these schemes. Seed of 27 kinds and 204 varieties (153 during 1976/77) was certified.

International activities

South Africa continued its membership of the OECD Herbage and Oilseeds and Vegetable Seed Schemes.

The 1978 annual meeting of representatives of certification authorities under the OECD seed schemes took place in Paris from 26 - 28 April 1978. South Africa was represented at this meeting by Mr L.J. Grobler, Assistant Director of the Division of Plant and Seed Control.

An International Seed Certification Scheme for Maize was introduced by the OECD and South Africa will apply for participation in the scheme with a view to the possibility of producing maize seed for export.

Mr J.J. Minnaar, Control Technician, visited various European countries to make a study of the certification of seed.

SEED POTATO CERTIFICATION

(a) Foundation seed potatoes (first multiplication)

Virus-free and variety-true breeding material from the Departmental establishments is multiplied in plots at Sabie. The following quantities were produced:

Variety	Number of units (30 kg)	
	Supplied to Potato Board	Held back for foundation seed potato production 1978/79
BP 1	1 225	300
Up-to-Date	971	200
Van der Plank	559	100
Late Harvest	404	30
Koos Smith	130	-
Code 155	-	20
Total 1977/78	3 289	650
Total 1976/77	2 904	630

The Department's contribution to the supply of virus-free seed potatoes is now clearly evident in the established seed potato industry, where fewer virus problems are being encountered and there are consequently fewer rejections of plantings for seed potato production.

(b) Foundation seed potatoes (second multiplication)

Foundation seed potatoes from the Sabie plot are multiplied by the Potato Board at plots at Lydenburg. Multiplication is subject to official inspection, mainly for the presence of viruses, and certified foundation seed potatoes are sold to the industry for the production of certified seed potatoes. The cultivation of potatoes within a certain area around the plot is prohibited by proclamation. The following quantities of foundation seed potatoes were certified (next page).

Variety	Number of units certified (30 kg)
BP 1	10 104
Up-to-Date	4 938
Van der Plank	2 232
Late Harvest	180
Total 1977/78	17 454
Total 1976/77	12 718

(c) AA-certification regions

- (i) *Field screening* - In the AA area, which is situated chiefly in the Northern Cape, the OFS and to a lesser extent in the Transvaal, Natal ant the Western Cape, 5 303 ha was submitted for inspection. This is about 57 ha more than during the previous year. A total of 970 ha was rejected, mainly because of too high a level of virus infection, the chief viruses being leaf roll and mosaic in the Up-to-Date plantings and Yn in the BP1 plantings.
- (ii) *Tuber inspection* - The quantity certified was 740 672 x 30 kg, as against 778 377 x 30 kg the previous year. About 114 000 x 30 kg was rejected, chiefly for exceeding the tolerances for nematode and potato tuber moth infestation, rotted tubers and infection with *Rhizoctonia solani*.

(d) A-certification regions

- (i) *Field screening* - A class seed potatoes are grown chiefly in the Transvaal, Eastern and Central Free State, Natal and the Western Cape. Only 171 ha of the 4 621 ha submitted for certification was rejected, the main reason being virus infection.
- (ii) *Tuber inspection* - 603 152 x 30 kg of tubers were certified, as against 747 921 x 30 kg the previous year. Approximately 50 859 x 30 kg was rejected for exceeding the nematode and potato tuber moth infestation and *Rhizoctonia solani* tolerances.

(e) General

- (i) *Varieties* - The relative importance of varieties of which seed potatoes were certified is indicated in the following table:

Variety	Quantity (x 30 kg units) of seed potatoes (classes AA and A) certified	
	1977/78	1976/77
BP 1	612 480	697 908
Up-to-Date	469 577	516 364
Van der Plank	161 063	188 905
King George	24 617	21 163
Kimberley Choice	23 050	19 962
Pimpernel	14 173	9 784
890/20	8 873	18 277
Late Harvest	8 524	-
Koos Smit	-	31 060
Other	21 467	22 875
Total	1 343 824	1 526 298

- (ii) The practice of removing foliage before virus-infected winged aphids from commercial plantings enter the seed lands is proving very effective in preventing virus infection.
- (iii) *Performance tests* - In all 2 044 samples were planted for purposes of performance testing. The tests give an indication of the efficiency of virus disease control by seed potato producers, whose continued membership of the Scheme depends on the outcome of these tests.

PLANT IMPROVEMENT SCHEMES

The plant improvement schemes in operation at present have no legal status and are administered solely on the basis of voluntary participation. Under the new Plant Improvement Act of 1976 it will be possible to establish schemes governed by regulations.

Vines

Selected Plant Scheme

(a) Parent blocks

(i) Rootstocks

A further 7 880 rooted rootstocks were established in approved blocks, which brings the total to 511 875 in 112 parent blocks.

The following numbers of rootstocks qualified for certification:

Scions	:	3 000 000
Cuttings for planting	:	2 500 000
Rooted rootstocks	:	200 000

(ii) Scions

In co-operation with the nurserymen's associations, the tracing of suitable material in the industry was started. It is expected that the first stocks for the delivery of scions of the most important varieties will be approved during the summer of 1978.

Super Plant Scheme

(a) Parent blocks

(i) Rootstocks

The following numbers of rootstocks (with the total to date given in brackets) were established:

Richter 99	:	24 015	(33 914)
101-14	:	21 502	(31 226)
Jacques	:	5 088	(10 088)
Total	:	50 605	(75 228)

(ii) Scions

No scion material is as yet available under the Super Plant Scheme.

Drupes and pomes

Selected Plant Scheme (best available or visually approved)

This scheme is being replaced as material from the Super Plant Scheme becomes available. A total of 11 nurseries are taking part in the scheme.

(a) Rootstocks

Nurseries provide their own material and, when available, rootstock material from the Super Plant Scheme is used.

(b) Scions

The following table shows the scale of production:

Kind	Number of varieties	Number of trees that qualify as propagation sources	Expected number of certifiable trees
Apples	2	909	8 628
Peaches	9	736	261 092
Pears	3	377	26 500
Plums	2	240	8 000
Prunes	1	76	1 671
Apricots	3	47	Geen
Total			
1977/78	20	2 385	305 891
1976/77	24	2 385	388 333

Super Plant Scheme

(a) Parent blocks

(i) Rootstocks

The following numbers of certified plants were established in 17 parent blocks from material supplied by the SAPIO:

Rootstock	Established 1977/78	Established earlier
M793	4 972	-
BP 2	1 916	-
MM106	1 539	-
Quince A	1 043	-
Marianna	623	1 394
Total	10 093	1 394

The intention is for the nurseries concerned to use the rootstock material in parent blocks for the production of rootstocks for nursery blocks.

(ii) Scions

Nurseries do not receive scion material for the establishment of parent blocks. The necessary material is produced by the SAPIO.

(b) Nursery blocks

(i) Rootstocks

The SAPIO, which had an overproduction of rootstock material, issued the following number of

certified cuttings to eight nurseries for direct establishment in nursery blocks:

Marianna	:	86 800
Quince A	:	30 920

(ii) Scions

The SAPIO issued the following number of certified buds to nurseries that qualify and have the necessary rootstock material:

Kind	Variety	Number of buds
Plums and prunes	Harry Pickstone	17 325
	Gaviota	8 600
	Prune d'Agen	7 950
	Santa Rosa	6 050
	Songold	1 975
	Golden King	100
Total		42 000
Apricots	Royal	12 700
	Piet Cillie	300
Total		13 000
Pear	Doyenne du Comice	20 350
	Bon Chrétien	14 200
	Packham's Triumph	1 900
	Beurre Hardy	500
Total		36 950
Grand total		91 950

The first Super Plant trees are expected to be available during 1979.

Strawberries

The scheme is still progressing favourably and is making a positive contribution to the improvement of the yield and quality. Eight nurserymen are participating in the scheme and the following numbers of plants of the various varieties were certified (with those for the previous year in brackets):

Parfaite	914 000	(1 003 000)
Selekta	890 900	(470 300)
Tioga	172 800	(465 400)
Tiobelle	120 000	(none)
Earlibelle	45 000	(none)
Total	2 142 700	(1 938 700)

Cherries

As a result of hail damage no trees were certified.

INSPECTION OF FLOWER BULBS FOR EXPORT

The area and number of bulbs inspected were larger than the previous year.

Winter bulbs

A total of 13 bulb varieties, covering an area of 72 ha and producing 90,8 million bulbs, were submitted for inspection. The most important varieties were *Ranunculus*, *Ornithogalum* and *Sparaxis*.

Summer bulbs

A total area of 18,5 ha, on which 9 varieties, producing 2,3 million bulbs, were grown, was submitted for inspection and approved. *Amaryllis* was the most important variety.

Chrysanthemums

Production increased in comparison with the previous year. Inspections were carried out at two nurseries with a view to exporting cuttings; 40,5 million cuttings were approved.

NURSERIES

Registration

The following table gives an indication of the distribution and the total number of nurseries registered with the Department:

Transvaal	729
Cape Province	604
Natal	284
OFS	57
Total	1 674

Of the above-mentioned, 240 nurseries produced vine material only. About 23 % of all nurseries are situated in the Witwatersrand-Pretoria area.

Inspections

In all 2 076 inspections were carried out at nurseries. In the process 492 plant samples, 130 soil samples and 3 water samples were taken for analysis.

Quarantine was imposed at 69 nurseries on account of the infection of plants with harmful pests and diseases. The total number of plants affected by quarantine amounts to 1,55 million. Crown gall (approximately 900 000 plants) was the largest single factor that led to quarantine. Approximately 180 000 infected plants were voluntarily destroyed by nurseries.

Stocks in nurseries

The following table shows the number of trees or plants together with the most important kinds or cultivars available in registered nurseries:

Group or kind	Total 1977/78	Most important kinds or cultivars	Total per kind or cultivar
Peaches	1,6 million	Kakamas Prof. Neethling Oom Sarel	171,6 thousand 146,2 thousand 235,9 thousand
Plums	225,4 thousand	Songold Santa Rosa Harry Pickstone	27,7 thousand 39,1 thousand 62,4 thousand
Apples	501,3 thousand	Granny Smith Star Crimson Top Red	163,1 thousand 118,9 thousand 114,7 thousand
Apricots	278,3 thousand	Bulida Royal	99,6 thousand 72,5 thousand
Citrus	1,5 million	Oranges Lemons Grapefruit	1,2 million 138,9 thousand 66,9 thousand
Subtropical fruit		Avocados Mangoes Loquats Litchis	386,7 thousand 271,2 thousand 47,0 thousand 90,7 thousand
Nuts	85,9 thousand	Almonds Other	56,8 thousand 29,1 thousand
Ornamental shrubs, trees and glasshouse plants, other kinds of fruit		Forest trees Ornamentals Glasshouse plants Roses Shrubs Hedge plants Palms Other kinds of fruit	20,6 million 4,9 million 4,7 million 1,15 million 7,6 million 4,7 million 600,8 thousand 464,1 thousand
Vines	9,4 million	Colombard	1,3 million
Grafted and rooted		Hermitage French Sultana Hanepoot	960,1 thousand 910,8 thousand 708,0 thousand 170,0 thousand
Ungrafted and rooted	1,5 million		
Cuttings	11,7 million	-	-
Rooted			
rootstocks	3,2 million	-	-

PEST CONTROL

Bacterial blight survey in vineyards

Re-inspection for the presence of bacterial blight was carried out on 272 000 mature grapevines. Quarantine was raised in the case of one plot.

In the Orange River region approximately 800 000 mature grapevines were inspected for the presence of bacterial blight. No infections were found.

Inspection of fruit for scale

A total of 219 155 units (1 053 of which were rejected) were inspected for the presence of scale. These inspections were carried out on fruit intended for export.

Compulsory orchard sanitation

With a view to the compulsory control of pernicious scale and grey scale 891 spraying orders were issued to owners of infested plots in the ten proclaimed districts of the Western and South-Western Cape. On average 87 % control was obtained. In all 237 samples were taken in order to

determine the presence of live insects and identify the scale.

Control of European red mite

Two infested plots were successfully treated.

Control of wart disease in potatoes

Surveys were carried out in the eight declared regions. Susceptible varieties were destroyed.

Embargo on the transportation of banana plants

In order to prevent the spread of burrowing nematode *Radopholus similis*, no person is permitted to transport or allow to be transported any banana propagating material in the Transvaal or Natal without a permit. Fifteen permits were issued after samples had been found to be free of infestation.

QUALITY CONTROL IN RESPECT OF IMPORTED AND EXPORTED PLANTS, PLANT PRODUCTS AND SEED

The Division is empowered in terms of the Seeds Act and the Agricultural Pests Act to exercise control over the quality and/or phytosanitary condition of plants, plant products (including seed), bees and apiary products that are imported and exported. Certain standards are laid down for the quality of imported seed.

As a member of the International Plant Protection Convention South Africa is involved in a world-wide campaign to prevent noxious diseases and pests of plants and plant products from crossing national borders. Certain requirements with regard to the phytosanitary condition of any material imported into the Republic are laid down in terms of the Agricultural Pests Act, and importation is subject to a plant import permit in which the requirements are specified. As evidence that the imported material meets the requirements, a phytosanitary certificate, issued by the authorities of the exporting country, must accompany each consignment.

Similarly, the Division issues phytosanitary certificates in respect of exported material in cases where specific phytosanitary requirements have been laid down by the importing country.

The phytosanitary provisions were revised in consultation with the Plant Protection Research Institute and copies sent to the FAO and member countries concerned in terms of the Convention.

Imports and exports in freight containers have increased considerably and the Division was obliged to adapt its organisation to the new set-up.

Imports

Seed declared under the Seeds Act

Table 2, (next page) indicates the

different seed groups and the quantities (kg) that were imported for different purposes.

The quantity of seed imported was four million kg lower than during the previous year, largely because of the reduction in the quantity of pea seed and grain sorghum seed imported.

On the basis of the mass of seed imported, the various crop groups represented the following percentages, in comparison with the previous four years reviewed (Table 3, next page).

In all 1 699 (1 750 the previous year) lots of imported seed were checked for compliance with the prescribed import requirements.

Judging by the number of lots examined, Durban, Cape Town, Pretoria and City Deep are the chief points of entry of seed.

Table 4 (next page) shows the number of seed lots which, for various reasons, did not meet the import requirements, and the names of the kinds most frequently involved.

Calculated on the basis of mass, 0,12 per cent of all seed did not meet the import requirements, for some reason or other, which is a further improvement on previous years.

Plants, plant products, bees and apiary products

Table 5 (next page) shows the mass or quantity of the various types of imported material inspected for diseases and insects, together with the number of plant import permits relating to the mass or quantity concerned.

There was a marked increase in imports of bulbs, tubers, herbs, spices, cane, fibre and timber in comparison with the previous year. However, fewer plants and cuttings and less seed, tobacco, fruit, cotton, nuts and seed potatoes were imported.

The number of phytosanitary inspections carried out on imported plants, plant products and apiary products amounted to 11 270 (or 2 700 more than during the previous year). A total of 1 683 plant import permits were issued.

The Plant Protection Research Institute examines the samples taken by the Division of plants and plant products on arrival in South Africa.

In all, 579 (711 the previous year) consignments were held back on account of inadequate documentation, prohibited imports such as honey, and infestation by mites, scale or nematodes. The following action was taken: documentation was rectified or consignments were destroyed, fumigated, treated or reconsigned to the country of origin.

Export

(a) Seed declared under the Seeds Act

Compulsory quality control is applied to export lupin seed only, chiefly in order to comply with EEC requirements. In terms of its powers under the EEC guidelines, West Germany extended the prohibition on the importation of uncertified

TABLE 2 - Purpose for which imported

Group	Commercial sales: listed varieties	Experiments	Multi- plication for export	Commercial sales: Un-listed varieties to relieve shortages	Re-exporting	Canning or processing	Production of fresh produce for export	Total
Vegetable crops	449 212	1 560	2 004	-	-	591 421	3 142	1 047 339
Field crops	3 658 861	2 070	-	2 100	-	-	-	3 663 031
Forage legumes	291 840	1 050	12 850	-	-	-	-	305 740
Forage grasses	1 094 651	60	-	-	-	-	-	1 094 711
Total 1977/78	5 494 564	4 740	14 854	2 100	-	591 421	3 142	6 110 821
Total 1976/77	9 093 061	5 332	130	265 000	73 600	920 193	-	10 824 346

TABLE 3
Crop group

	1977/78	1976/77	1975/76	1974/75	1973/74
Vegetable crops	17,14	41,82	27,86	47,80	42,99
Field crops	59,93	49,22	47,80	36,96	39,22
Forage legumes	5,00	1,94	14,09	3,13	1,43
Forage grasses	17,93	7,02	10,25	12,11	16,86

Defect	TABLE 4	Number of lots	Kinds most frequently involved
Germination too low		11	Sunflowers, lettuce
Physical purity too low		1	Rhodes grass

Nature of imported material	Mass or quantity inspected (kg, unless otherwise indicated)	Number of plant import permits concerned
TABLE 5		

Plants and cuttings	1 841 516 units	445
Bulbs, tubers and rhizomes	40 937 230 units	118
Seed potatoes	92 327	15
Seed (declared under Agricultural Pests Act)	4 090 279	796
Potatoes (table)	-	-
Tobacco	8 806 351	33
Fruit	396 152	15
Cotton and cotton samples	15 436 406	91
Broom-reeds	10 120	2
Beeswax	18 251	11
Nuts	790 064	1
Timber	354 427 m ³	-
Herbs, spices ginger, etc.	3 968 997	38
Cutflowers (fresh and dried)	26 003	2
Fibre, cane, peat moss	18 248 392	35
Commodity seed (not declared)	4 646 805	81

and insects, together with the number of phytosanitary certificates issued after such inspections (which often included the inspection of the plants during the growing stage):

TABLE 6

Nature of exported material	Mass or quantity inspected (kg, unless otherwise indicated)	Number of phytosanitary certificates issued
Seed (general)	153 325 326	1 277
Plants and cuttings	46 033 099	782
Bulbs, tubers and rhizomes	48 616 877	440
Cutflowers (fresh and dried)	1 908 575	3 583
Other (wheat, bran, poultry feed, etc.	137 478 381	195
Timber	519 517 m ³	22
Honey	12 116	3
Potatoes (seed)	5 721 825	68
Potatoes (table)	5 755 844	356
Maize	2 517 163 768	1 114
Vegetables, etc.	30 121 648	4 342
Fresh fruit	1 101 482 598	2 996
Groundnuts	36 986 173	764
Nuts	10	1

The quantities of seed potatoes, table potatoes, bulbs and tubers submitted for phytosanitary certification were lower than last year. On the other hand, larger quantities of maize, seed, vegetables, plants and cuttings, cutflowers, fresh vegetables and timber were certified for phytosanitary purposes.

In all, 15 943 phytosanitary certificates (or 2 695 more than during the previous year) were issued.

lupin seed to 31 March 1979.

International seed analysis certificates are issued on a voluntary basis. In all 403 certificates of this type, covering 3 009 981 kg seed (chiefly lupin, beans, maize, Rhodes grass and weeping love-grass), were issued.

(b) Plants and plant products

Table 6 shows the mass or quantity of the various types of export material inspected for diseases

(c) EEC guidelines

Because the Republic exports seed to EEC member countries, EEC guidelines regarding requirements for the quality of seed, the marking of containers, seed certification, quality control and related matters have to be taken into account.

QUALITY CONTROL

PLANT INTRODUCTION AND THE STORAGE OF GERM PLASM

It is the official policy that all imports and exports of samples of plant propagating material on behalf of Departmental bodies should be handled by the Division.

The following table indicates the number of samples handled by the Plant Introduction Officer.

	1977/ 78	1976/ 77	1975/ 76	1974/ 75
Number of samples exported for research	8 701	10 587	4 707	4 129
Number of samples imported for local researchers	1 703	2 943	4 159	3 205
Number of samples imported for rust gardens	6 504	9 115	8 922	8 983
Total handled	16 908	22 645	17 788	16 317

The plant material handled belonged chiefly to the following kinds: wheat, maize and fruit. The Republic obtains germ plasm material from and supplies it to a large number of countries. Good relations are maintained with researchers in countries that are otherwise not well disposed towards us. In this way, for instance, copies of Part Six of "Index Seminum", which includes a list of available germ plasm samples, was sent to 78 bodies in foreign countries.

The development of a second quarantine station at Buffelspoort by the Plant Protection Research Institute should greatly facilitate the importation of seed samples for which phytosanitary certificates cannot be obtained.

In all 298 new seed samples were placed in the germ plasm bank (gene pool) for indefinite storage.

VARIETY CONTROL

Variety control consists of -

- (a) granting recognition to varieties with a view to including them in the varietal list, which is kept in terms of the Seeds Act, and/or awarding of plant breeders' rights under the Plant Breeders' Right Act; and
- (b) checking on the maintenance of varieties -
 - (i) of which the names have been included in the varietal list, or
 - (ii) in respect of which plant breeders' rights have been awarded.

Recognition of varieties

Nobody may, without the permission of the Minister, sell seed of a kind declared under the Seeds Act, unless the name of the variety concerned has been included in the varietal list.

When seed is sold the name of the variety must be indicated. A candidate variety is included in the varietal list only if it is distinguishable from

other varieties of which the names have been included in the list, is homogeneous and stable and has been awarded a distinguishing name. The Minister may refuse to include an inferior variety in the list.

The purpose of the varietal list is to avoid the sale of the same variety under various names or various varieties under the same name or the sale of seed of inferior varieties. With this view all candidate varieties have to be examined in accordance with certain guidelines, and this examination usually includes growing the adult plants.

The following table shows the kinds, and the number of varieties of each kind for which applications for inclusion in the varietal list were received, and the varieties that have been included in the list.

Kinds	Number of varieties for which applications for inclusion in the list have been received	that have been included in the list
Maize	39	14
Tomatoes	5	-
Grain sorghum	4	-
Cauliflower	-	2
Soya-beans	4	-
Cotton	3	1
Onions	2	-
Dwarf beans	2	-
Garden beets	-	1
Cabbage	5	3
Carrots	-	1
Lucerne	-	1
Tall fescue	-	2
Pennisetum	1	-
Cucumbers	8	5
Subterranean clover	1	2
Cow-peas	-	1
Muskmelons	-	2
Total 1977/78	74	35
Total 1976/77	81	49
Total 1975/76	74	65
Total 1974/75	66	92

The number of applications and the number of varieties included in the list were lower than the previous year. Maize, tomatoes, grain sorghum and soya-beans are the most important kinds for which applications were received.

Plant breeders' rights

The Plant Breeders' Rights Act, 1976, came into operation on 1 November 1977. Regulations made under the Act were published in the Government Gazette (No. 5788 of 28 October 1977).

South Africa joined the International Convention for the Protection of New Plant Varieties on 7 November 1977 and in so doing established ties in respect of plant breeders' rights on a reciprocal basis with nine other countries (that have already ratified the Convention). The

Republic also entered into direct reciprocal agreements on plant breeders' rights with two other countries that have not yet joined the Convention. This means that plant breeders in 11 foreign countries can now register their rights regarding new varieties of plants in South Africa, while South African plant breeders have the same privilege in the foreign countries concerned, in addition to having the privilege of being able to register such rights in the Republic.

The holder of plant breeders' rights enjoys -

- (i) the sole right to produce, sell, import and export propagating material of the variety in respect of which he obtained the rights for a certain number of years; and
- (ii) the right to collect royalties from persons to whom he grants licenses, after the expiry of the period of sole right, for the performance of the same functions he had permission to carry out.

The examination of new varieties for the granting of plant breeders' rights is basically the same as the examination for inclusion in the varietal list and can therefore be carried out simultaneously in appropriate cases.

The following table summarises the numbers of varieties in respect of which applications for plant breeders' rights were made to the Division, the numbers of varieties in respect of which rights were granted and the total number of varieties for which plant breeders' rights are held at present:

There has clearly been a considerable increase in the number of applications for plant breeders' rights during the past year.

Mr J.F. van Wyk, The Director, was appointed a member and Mr J.U. Rietmann an alternate member (representing South Africa) of the Board of the Union for the Protection of New Plant Varieties (UPOV).

Messrs Van Wyk and Rietmann attended the UPOV Board meeting in Geneva from 6 to 8 December 1977, and Mr Rietmann attended most of the meetings of the UPOV working groups and technical committees.

The Convention for the Protection of New Plant Varieties was submitted for revision to a conference taking place in Geneva from 9 to 23 October 1978.

Control of the maintenance of varieties

The maintenance of varieties of which the names appear in the varietal list or in respect of which plant breeders' rights are held can be controlled in terms of legislation. This control is exercised by growing plants from samples taken from certified or commercial seed or by inspecting the maintenance programmes at the premises of the plant breeders or maintainers concerned. As soon as it is established that a variety is not being maintained so as to conform to its original description, its name can be removed from the

Kinds	Number of varieties in respect of which applications were made for plant breeders' rights 1977/78	Number of varieties in respect of which plant breeders' rights were granted 1977/78	Total number of varieties for which plant breeders' rights are held at present	Number of varieties in respect of which the award of plant breeders' rights is still being investigated
Roses	10	12	12	18
Peaches	10	3	5	16
Soya-beans	4	2	2	2
Wheat	-	-	-	-
Tomatoes	-	6	6	-
Maize	-	6	6	-
Proteas	-	5	5	-
Nectarines	1	3	3	2
Dwarf beans	-	3	3	-
Hops	-	1	1	-
Lucerne	-	-	-	2
Apples	1	-	-	3
Peas	2	-	-	3
Groundnuts	-	1	1	-
Oats	-	-	-	-
Apricots	1	-	-	2
Lupins	-	2	2	-
Sunflowers	-	-	-	-
Cotton	-	-	-	2
Babala	-	-	-	-
<i>Eragrostis curvula</i>	-	-	-	-
Plums	-	1	1	-
Grapes	-	-	-	-
Triticale	-	-	1	-
Grain sorghum	-	-	-	-
Pecan nuts	-	-	-	-
Gem squashes	-	-	-	-
Aloes	-	1	1	-
Beetroot	-	1	1	-
Pears	-	-	-	1
Chinkerinchee	-	-	-	-
Total	29	47	50	52

varietal list or the rights held in connection with the variety can be cancelled or the sale of the seed lot can be prohibited.

4 344 samples of 60 kinds were tested for control purposes. The most important kinds (with the number of samples tested in brackets) are: maize (512), potatoes (329), tomatoes (232), onions (231), lupins (194), grain sorghum (187), dwarf beans (174), cabbage (160).

Breeders' plant material

The purification and maintenance of varieties was continued in co-operation with officers from several regions and institutions, in order to obtain propagating material of a high genetic quality for use in the production of certified material. The following table shows the kinds, number of varieties and quantities of breeders' seed produced and issued:

Kinds	Number of varieties	Quantities produced (kg)	Quantities issued (kg) under the Seed Certification Scheme
<i>Vegetable crops</i>			
Beetroot	1	-	1,2
Cauliflower	1	8	-
Beans	1	86	32
Peas	1	160	-
Carrots	1	-	1
Pumpkins	1	69	-
Tomatoes	2	27	4,5
Gem squashes	1	30	8
Onions	5	20	10
<i>Field crops</i>			
Potatoes	6	118 170	98 670
Dry beans	7	9 367	-
Groundnuts	1	111	25
Cotton	1	30	-
Lupins	1	700	-
Cattle melons	1	-	1,5
Soya-beans	1	-	300
<i>Pasture crops</i>			
Rye grass	1	875	525
Rough cocksfoot	1	20	18

It is clear from the above that an active breeders' seed programme is being maintained.

Analysis, examination and testing of seed

The Division renders an invaluable service in connection with control over the seed trade, seed certification, seed exporting and seed research in that its seed testing station tests, analyses and examines seed samples for purity, germination, moisture content, weed content and other properties related to seed quality.

The following table shows the total number of seed samples of field crop, horticultural and forestry species received by the Division for various purposes.

Seed group	Purposes In terms of the Seeds Act						Total
	Private	Certification scheme	Trade checks	Export seed	Import seed	Re-search	
Field crops	4 460	3 711	1 696	360	296	127	10 650
Horticulture	5 152	806	1 041	43	821	159	8 022
Forestry	-	-	-	-	-	299	299
Total 1977/78	9 612	4 517	2 737	403	1 117	585	18 971
Total 1976/77	7 899	1 164	2 893	362	1 361	678	17 357

Most of the samples received for testing were of the following kinds: grasses, maize, sorghum, lupins, beans, peas, crucifers, curcubits, tomatoes, onions and carrots.

In all 44 187 individual tests were carried out, 21 379 of which were for germination, 9 619 for purity, 3 911 for defective seed, 3 443 for grading and 1 600 for weed content.

South Africa continued its membership of the International Seed Testing Association. The following officers of the Division serve on various committees of the Association:

Mr J.F. van Wyk	:	Executive Committee
Mr J.F. van Wyk	:	Rules Committee
Mr J.F. van Wyk	:	Seed Moisture and Storage Committee (Chairman)
Mr J.F. van Wyk	:	Flower Seed Committee
Miss E. Robert	:	Purity Committee

The Division is empowered to International Seed Analysis Certificates.

III. Animal Production Improvement

LIVESTOCK PRODUCTION RESEARCH

BEEF CATTLE

Production systems

It was mentioned in the 1976/77 annual report that fertilised veld in summer on the Highveld can carry twice as high a stocking rate as unfertilised veld and can consequently produce twice as much veal per unit area. This study was repeated in 1977/78, with the difference that the stocking rate was increased by 2 % on fertilised veld and decreased by 18 % on unfertilised veld. As in 1976/77, the cows and calves maintained better mass increases and growth on fertilised than on unfertilised veld. The higher stocking rates on fertilised than on unfertilised veld are reflected by higher mass increases of calves per hectare - 113 % and 163 % higher in 1976/77 and 1977/78 respectively.

The average recalving percentages of cows on sandy sourveld at Dundee, Natal, were 96, 85,8, 85,8 and 73,1 for cows that received an energy lick, a natural protein lick, a non-protein nitrogen lick and no supplementation, respectively.

In an investigation into the production potential of heifers that calved at the age of two years instead of three years, it was determined that the former produced 0,7 more calves over a period of five years at Dundee than those that calved for the first time at three years. It was interesting to note that the early calving system did not inhibit the skeletal development of these heifers.

In a related study at Glen, a covering age of 15 months was compared with one of 27 months. Simmentaler heifers were used in the investigation. In spite of the fact that only 10,5 % of the younger heifers attained an optimum covering mass of 418 kg, 64,8 % of these heifers calved at two years, as against 84,6 % of the control group, which was covered at 27 months. The weaning masses of calves in the control group were 18 kg more than those of the group covered at 15 months, and the latter group weighed 49 kg less at three years than the control group. The most important advantage resulting from the policy of covering at 15 months instead of 27 months was the fact that the early covering group was able to produce 26,5 % more weaner mass up to the age of three years than the late covering group.

In a trial in the Highland sourveld of Natal the performance of cows and calves at two different

stocking rates, namely 0,6 and 0,9 LSU/ha, were compared. In addition to the two stocking rates, two different lick supplementation programmes were used. In the one case a winter lick was provided throughout the summer. In the other case a salt dicalcium phosphate lick was provided from the beginning of summer to 15 February, followed by a winter lick. There were no significant differences in respect of mass changes of the cows, their reconception rate or the weaning masses of the calves.

These results show that a stocking rate of over 0,6 LSU/ha is in fact possible in this area, but the condition of the veld should be watched.

At Cedara the performance of dual-purpose and British crossbred cows and their calves on kikuyu grazing was compared during the summer season. Weaning masses of 188 and 202,5 kg were realised by dual-purpose calves on a high (6,74 cows and calves/ha) and a low (4,12 cows and calves/ha) stocking rate respectively. The corresponding figures for the British crosses were 190,3 and 214,2 kg.

The pre-weaning growth of the calves and the milk production and the reconception rate of the cows were not affected by the stocking rate. It did, however, play a part in respect of the mass and condition of the cows, as well as in respect of the period for which grazing could be utilised. The quantities of beef produced per hectare during the grazing period were 836,4, 548,0, 820,3 and 657,8 kg for the high and low stocking rates, for the dual-purpose and British crossbred calves respectively.

The inclusion of *Cenchrus ciliaris* in production systems in the sweet and sour mixed Bushveld of the Transvaal appears promising. The following norms were established in various investigations: a calving percentage of 94, a weaning mass of 213 kg and average daily gains of 0,9, 1,0 and 0,75 kg for heifer calves, bull calves and year-old steers respectively.

In production systems in the Winter Rainfall Region at Tygerhoek and Nortier a major goal is to include beef cattle effectively in the farming pattern. Attention is also given to the influence of ruminants on the grazing cover. Furthermore, the economics of beef cattle farming is being compared with farming operations in other livestock industries. It should be borne in mind that beef cattle still play a very minor part in the Western Cape at present.

Management

Beef production research in South-West Africa is concentrated to a large extent on production from the natural grazing. The emphasis is on improved management practices, with optimum reproduction, veld evaluation and feed intake studies as first priorities. In view of the fact that intensive finishing of oxen has become a risky undertaking as a result of the unfavourable grain-meat price ratio, an investigation was started at the Sandveld Research Station to determine the merits of finishing oxen on the veld with no aids other than improved management practices. The results were favourable.

With a winter protein lick as the only supplementation, Africander oxen were marketed at 26 months with an average net slaughter mass of 228 kg, an average Prime A grading and average net proceeds of R196,15.

A programme to determine the optimum production of red meat in the dry grass-bush community of the Eastern Cape has been in operation at Adelaide for some time. A theoretical model for optimum production is used and the results indicate that the full potential has not yet been reached. The data for the 1977/78 season indicate a considerable improvement in comparison with the 1976/77 season. The calving percentage, for instance, increased by 21 %, weaning masses by 3 %, mass increases by 3 % and body masses per hectare by 16 % in spite of a decrease of 21 % in the stocking rate.

In an observation trial on the Highveld an investigation into the economic and practical implications of concentrate supplementation for Africander weaner heifers and two-year old Africander heifers on mixed winterveld was carried out. It was found that with the inclusion of about 10 % salt the daily intake of concentrates could be limited to 1,5 and 1,0 % of the live mass of weaner heifers and two-year old heifers respectively. It was found that, in comparison with a similar feeding situation created under feedlot conditions, weaner heifers can, on a basis of mass change and feed costs, be overwintered just as economically on the veld with a concentrate supplementation of 1,5 % of live mass per day, as under feedlot conditions. As regards two-year old heifers, a concentrate supplementation at 1 % of live mass per day is insufficient under veld conditions and the concentrate is utilised less economically than in feedlots.

Breed and type evaluation

At the Vaalharts Research Station, where the suitability of various types of breeds and their crosses is at present being investigated as a basis for the production of beef cattle in purebreeding and crossbreeding systems, the progeny already numbers 576. This is approximately half the number planned and consists of 39 breeds or breed combinations. All female progeny are evaluated as potential breeding cows and all steers as potential

slaughter animals, which means that the steers are slaughtered at four masses from weaning mass to 440 kg.

At Armoedsvlakte progeny have already been produced from eight European beef and dual-purpose breeds and their evaluation as slaughter animals and female breeding animals has reached an advanced stage. It would appear that the Chianina-, Gelbvieh- and Normandi-Africander crosses can be singled out at this stage as good parent strains.

Various breeds are also being evaluated at Omatjenne in South-West Africa, including the indigenous Owambo-Kavango breed, namely the Sanga. Animals of this breed are small in their natural habitat, which can probably be ascribed to poor management and insufficient feeding. Since the animals arrived at Omatjenne, however, their body masses and weaning and year-old masses have increased steadily. The Sanga appears to utilise veld grazing better than the heavier exotic breeds.

A study carried out over the past five years in which calves born in the same year were compared in respect of percentage mass increases from weaning to 18 months showed that the Sanga attained the highest percentage mass increase (64,3 %), followed by the Hereford (54,0 %), the Santa Gertrudis (53,2 %), the Africander (49,7 %) and the Simmentaler (48,3 %).

A study was undertaken in the Eastern Cape to investigate the physiological adaptation of Shorthorn, Africander and Bonsmara heifers in respect of feedlot and veld conditions. The adaptation norms investigated were adrenal cortex and thyroid activities. It became evident that there was no stress worth mentioning, that the secretion of thyroxin is a better physiological criterion of adaptability than that of cortisol and that the Shorthorn and Bonsmara are better adapted under the intensive housing and feeding programmes than the Africanders.

Reproduction

The synchronisation techniques found most promising with Africander cows at Armoedsvlakte were investigated with cross-bred as well as pure-bred Africanders at Vaalharts this year. Their synchronisation response was reasonably satisfactory (81 %), although the pure-bred Africanders showed an average of 12 % less oestrus than cross-bred cows. The preliminary results have again shown that the breeding technique is not yet satisfactory enough for general application, and it will not be possible to evaluate the possible effects of the particular breed until after the calving season.

The pregnancy performances of 495 lactating cows and 99 replacement heifers on the sourish mixed Bushveld at Soutpan were compared over a period of three years. A summer covering season and controlled selective grazing were applied. A salt-controlled dicalcium phosphate protein lick was freely accessible during the year. The breeding herd

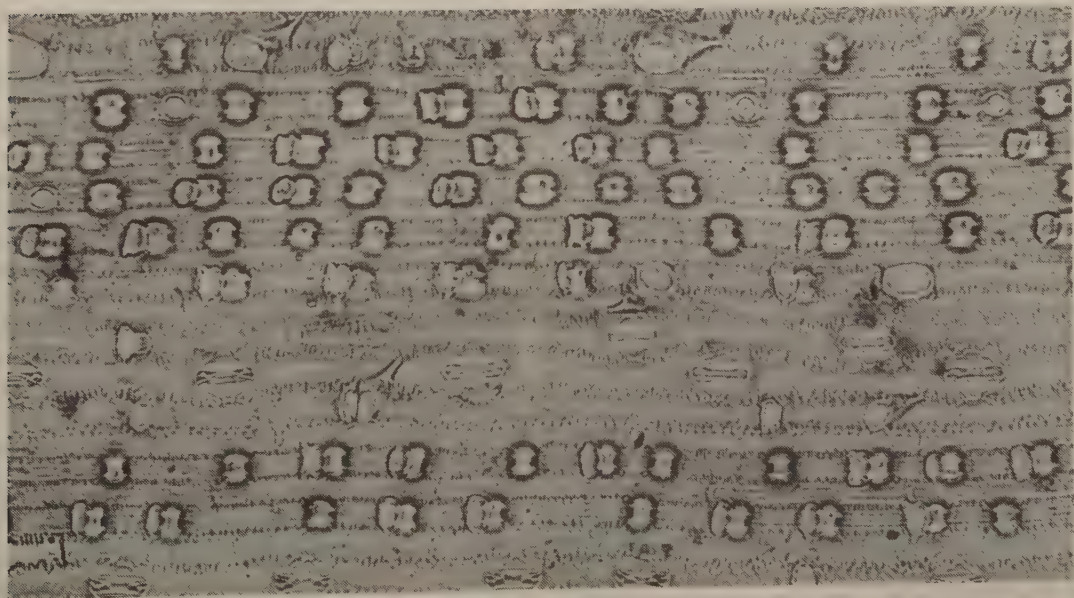
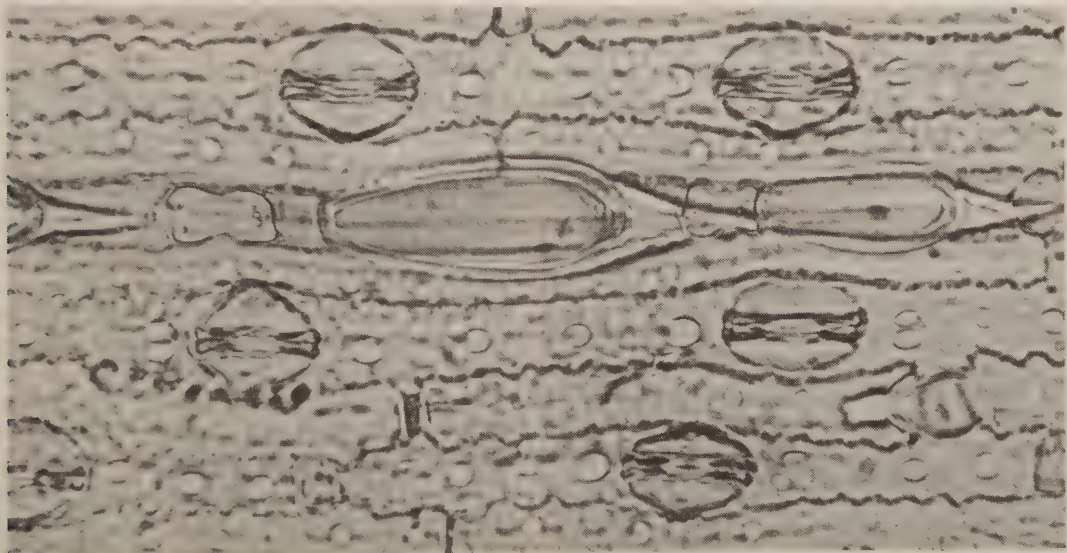
consisted of Simmentaler and Africander cross-bred cows and heifers, covered by pure-bred Africander and Simmentaler bulls according to a criss-cross system. An average of 88 % of the lactating cows became re-impregnated, compared with the 86 % of the two-year old heifers.

A number of differences between Africander cross-bred cows and heifers and Simmentaler crosses were observed: Africander crosses gave a lower pregnancy rate of 6 % among cows and 8 % among heifers. The impregnation of Africander crosses improved from two to five years, whereas Simmentaler crosses maintained a higher and relatively stable impregnation at all ages. In both crosses the highest re-impregnation rate occurred in cows that had calved early in the season, but in the case of Africander crosses a lower impregnation rate, particularly in cows that had calved late, was observed. The cross-bred Africander replacement heifers continued calving far into the season while

the older Africander cross-bred cows tended to calve later in the season.

Feeding aspects

The extent to which silage can replace concentrates in finishing rations as a source of energy is being investigated in the Highveld. It was found that, because the dry matter intake is insufficient, maize silage does not provide sufficient energy for efficient meat production. This statement is supported by the fact that oxen in the trial showed better mass increases where silage was replaced to an increasing extent by energy-rich concentrates in finishing rations. On the other hand there are economic considerations: Maize silage plus a protein supplement in the finishing of beef cattle often results in a higher profit over and above feed costs than concentrate rations.



The abaxial epidermis of rooigras *Themeda triandra* and knietjiesgras *Eragrostis lehmanniana* under the microscope.
This method of grass identification is used in the examination of fistula samples of small and large stock

The average crude protein contents of veld grass samples at Dundee for the summer, autumn, winter and spring were 5,88; 4,20; 3,80 and 5,60 % respectively. The average calcium and phosphorus contents did not vary significantly and were 0,17 and 0,11 % respectively. With these data in mind and working on an assumed value for the total digestible nutrients present, it was calculated that the veld can supply 90, 65, 65 and 42 % of the total digestible nutrients, the crude protein and the calcium and phosphorus, respectively, needed by the lactating cow.

Measurement of performance

The possibility of an interaction between breed and feed is being intensively investigated at Irene with bulls of the Africander, Hereford and Simmentaler breeds and a concentrate and roughage ration. The information gathered in respect of the three breeds on both rations includes voluntary feed intake data, measurements of mass and estimates of body composition at regular intervals from birth to maturity. The object is to determine whether the order in which these three breeds can be placed in respect of these data and efficiency criteria differs for concentrates and roughage.

The data obtained so far (from birth to 18 months) show an identical relative order between the three breeds on the two rations. In terms of mass produced per total digestible energy intake from birth to 18 months, the relative performance of the Africanders was taken as 100, Herefords as 118 and Simmentalers as 129. As a matter of interest may be mentioned that the masses at 18 months were 400 - 600 kg on the concentrate ration (depending on breed) and 280 - 450 kg on the roughage ration.

It has become necessary to find a suitable indirect criterion of body composition, particularly fat, for beef cattle. This is particularly important in the performance testing of bulls, where an estimate of body composition, naturally without slaughtering, is an advantage in the total evaluation programme. The urea and tritium dilution technique appeared to have possibilities and was tested at Irene with the aid of bulls from the Africander, Bonsmara, Charolais, Friesland-Africander cross and Hereford breeds. Prediction ratios between urea or tritium space and the components of body composition, as directly determined by slaughtering, mincing and chemical analysis of the bull carcasses, were worked out.

A reliable estimate can be made of the majority of components of the body as a whole, but the estimation error (20 - 25 %) for fat is comparatively large, with the result that the urea or tritium space has to be determined at intervals in order to obtain a reliable estimate. The components of the carcass can also be estimated satisfactorily, although the errors in this case are relatively larger than in the case of the whole body. Fat is also an exception. The relationship to subcutaneous fat,

which is decisive in grading, is even poorer. Because of the high cost and intensive labour involved in repeated measurements, it would appear that these methods will not be generally accepted on a large scale at bull performance testing centres.

MUTTON SHEEP AND GOATS

Production systems

In the Highveld Region the overwintering of sheep remains one of the basic problems in establishing a flow programme of feed provision over a period of a year. Specific research was therefore started on the evaluation of locally available sources of roughage as feed sources for full-grown sheep and slaughter lambs. With regard to energy provision from maize silage, it has already been found that lambs can be successfully finished on a ration consisting of 70 % maize silage and 30 % concentrates and containing 14 % crude protein, 6 % of which is included as supplementation.

With regard to protein supplementation in a silage ration of this kind, vegetable and animal protein sources (natural protein) and non-protein nitrogen (NPN) were considered as alternatives. It was found that natural protein, as supplementation, can be replaced completely with NPN without the risk of poisoning and that 50 % can be replaced by NPN without any significant influence on the growth of lambs. Here it must be taken into account that up to 50 % of the total nitrogen in maize silage may be NPN.

In further research, based on carcass grading, optimum protein and energy levels for slaughter lamb production are being investigated. There is a strong indication that if the provision of concentrates (in the form of maize meal) is increased from one to two per cent of live mass, while the protein content of the total diet decreases from 14 to 11 %, and 60 % improvement in carcass quality, according to grading, can still be obtained. It should be mentioned that maize silage is still used as the basic feed in this study.

In an evaluation programme for winter green feed carried out at the Bethlehem Agricultural Research Station, South African Mutton Merino lambs were finished for 118 days after weaning on a control ration (consisting of 50 % maize meal plus 50 % lucerne meal) triticale, rye, rye grass, wheat and oats. On the basis of net farm income per slaughter lamb, it was found that triticale and rye performed better than the control ration but Italian rye grass, wheat and oats gave a poorer performance. Calculated at the prevailing meat price conditions (1978) and taking into account the winter conditions of 1977, net farm incomes varying between five and ten rand per lamb were recorded with the various crops. The use of winter green feed in slaughter lamb production therefore appears promising in the Eastern Free State. This study is being continued in order to obtain conclusive results on the influence of varying

climatic and soil conditions and improved cultivars on the productivity of the system.

More extensive pasture plantings in the grain-producing areas have stabilised sheep farming and helped promote more intensive production systems. This trend was reinforced by the establishment of pastures under irrigation on submarginal lambs in the grape, fruit and vegetable producing districts. There is a great demand for dual-purpose ewes as well as mutton breed rams for crossbreeding, and attempts are being made to increase production by means of more intensive replacement, shorter inter-lambing intervals and higher reproduction capacity.

The Winter Rainfall Region's research programme includes attention to these developments. Various breeds and crosses are being used in a slaughter lamb trial at the Outeniqua Experimental Farm. An average lambing percentage of 112% was maintained over a five-year period and lambs aged 5 months produced carcasses of about 16 kg each. Cross-bred lambs grew about 8% faster than pure-bred lambs and the lambing percentage of cross-bred ewes was 13% higher than that of pure-bred ewes. However, the higher production makes greater management demands on the farmer as a result of the different types of animals involved and takes place at the expense of selection pressure. Under the current conditions, where good dual-purpose ewes are virtually unobtainable, the system of cross-breeding cannot be recommended without reservations.

In a trial with Dormer ewes at Elsenburg an accelerated mating frequency (3 lamb crops in 2 years) virtually doubled the number of lambs born while the mass of lamb produced per ewe was increased by 37%. Additional expenditure on supplementation was, however, necessary, and the high mortality rate among lambs (34%) again emphasised the importance of good management under intensive conditions. A project has recently been started at Elsenburg in which the effect of special attention to sheep during the lambing period is being investigated.

An investigation into the nutritional value of *Medicago truncatula* revealed that medic curls are insufficient as the sole source of feed for sheep. A carrying capacity of at least five sheep per hectare was maintained throughout the year on medic pastures and during the growing season it was as high as seven.

The following four fat lamb production systems are being tested at Cedara in the Natal Region:

System 1

- (a) Three lambing seasons in two years
- (b) Oversummering on kikuyu pastures
- (c) Overwintering on rye grass pastures for a limited period
Maize silage ad lib.

System 2

- (a) Three lambing seasons in two years
- (b) "O" grazing. Hay and silage with concentrate supplementation

System 3

- (a) Three lambing seasons in two years
- (b) Oversummering on kikuyu pastures
- (c) Overwintering on maize silage plus supplementation

System 4

- (a) Autumn lambing season per year
- (b) Oversummering on kikuyu pastures
- (c) Overwintering on maize silage plus supplementation

Up to now the ewes in systems 1, 2, 3 and 4 have performed as follows:

	System 1	System 2	System 3	System 4
% ewes that lambed	87,38	91,7	85,8	69,4
Lambing percentage	122	150	138	129
Fecundity	1,55	1,64	1,64	1,85
% single births	44,9	35,5	36,0	14,7
% multiple births	55,1	64,5	64,0	85,3

Boer goats

The Boer goat has excellent reproductive qualities, good meat qualities and grazing habits that can best be utilised for additional red meat production, together with cattle farming, in the dry grass bush communities. The production data obtained at the Adelaide trial plot, where cattle as well as Boer goats are included in a multiple utilisation system for this type of veld indicate that the role of the Boer goat is being completely underestimated in a farming area which extends over 40 000 ha. The production data obtained up to date are as follows:

	1976/77 season	1977/78 season	Change (%)
Lambing percentage	187	202	+ 8
Weaning percentage	145	192	+ 32
Mass/ha (increase) kg	10,9	16,3	+ 49
Increase g/day	169	176	+ 4

Research on the Boer goat is continuing in the SWA Region and attention is being paid to management practices such as the inclusion of Boer goats in cattle farming enterprises, the correct choice of mating times and the raising of lambs. At present one of the biggest problems is still mortality among lambs, which can be as high as 40%. During the 1976/77 lambing season at the Omatjenne Research Station a lambing percentage of 159,5 was obtained with Boer goats, 7,7% of which were still-born. Furthermore the losses up to weaning age amounted to almost 20%. As regards fecundity, it is interesting that only 12,3% single



These ewes have a blood composition of 50 % S.A. Mutton Merino, 25 % Merino and 25 % Ronderib-Africander. This cross is used in the development of white-woolled mutton sheep at the Carnarvon Research Station

births occurred, as against 62,7 % twins, 22,2 % triplets and 2,8 % quadruplets.

Breeding

Good progress has already been made with the development of a white-woolled mutton sheep for the extensive Karoo sheep grazing regions. The crossing with a genetic make-up of 50 % SA Mutton Merino, 25 % Merino and 25 % Ronderib-Africander was decided on. The numbers of this crossing were multiplied during the past year to allow for stricter selection for the further development of the new breed.

As in the previous year, the crossing is maintaining a relatively high reproductive capacity (95 %) under extensive conditions. The lambs have a high growth rate, as is reflected by the fact that the body masses of ram and ewe lambs at the age of twelve months were 51,53 kg and 43,04 kg for the year under review.

In the breeding project with Dorpers that is being carried out at the Koopmansfontein Research Station, a lambing percentage of 81,5 was attained during the 1977 summer lambing season. The ewes were again mated during February and March for the following eight months' cycle, during which time the masses averaged 58,2 kg. Good weaning masses were obtained for lambs, the average being 21,24 kg at 60 days. Of these lambs, 18,95 % were multiple births.

The question of freezing Boer goat semen is still being studied. The object is to improve the survival of sperm after thawing even further. In a series of laboratory tests it was found that centrifugation of both fresh and washed semen

increases sperm survival. In both cases the supernate is removed after centrifugation, before the semen is diluted again, cooled and frozen. This beneficial effect can clearly be seen from the survival of sperm during incubation for six hours after thawing, and it is expected to be possible to extrapolate this effect to the survival of sperm in the female genital tract, with a consequent higher lambing percentage.

PIGS

Feeding

The use of sunflower oilcake meal as a source of protein in the ration of growing pigs was studied at the Animal and Dairy Science Research Institute in order to determine the optimum economic inclusion rate for sunflower oilcake meal in pig growth diets.

It was established that 18 % sunflower oilcake meal is the economic optimum, provided the lysine level in the ration is supplemented with synthetic lysine. Optimum growth was obtained at a ration lysine level of 0,85 %, although optimum carcass grading was obtained at a lysine level of 0,80 %. The optimum lysine level consequently appears to be 0,80 %.

This study also proves that an effective pig growth meal can be made up without wheat bran by using only maize meal and sunflower oilcake, supplemented with a sufficient quantity of lysine plus the necessary minerals and vitamins.

During the year under review a project on the least cost rations for baconers was completed in the Winter Rainfall Region. Valuable information was

obtained in respect of the requirements of pigs of certain nutrients and the recommendations made can serve as guidelines for future feed standards for baconers. A project in which triticale was evaluated as a feed grain for pigs was also completed. It was found that triticale can replace maize in diets for growing pigs provided the essential amino acids in such diets meet the specific requirements of the pig.

Fish meal samples obtained from fishmeal factories in the Cape and South-West Africa were analysed at the Animal and Dairy Science Research Institute for their crude protein, lysine and chemically reactive lysine contents. Although the protein content of the SWA fishmeal was higher on average, the Cape fishmeal was of a better quality. Cape fishmeal contained an average of 5,88 % lysine, as against 5,80 % in the SWA fishmeal. On the other hand the Cape fish meal contained an average of 5,52 % available lysine as against only 3,73 % in the SWA fishmeal.

The variation in the composition of a number of sunflower oilcake samples collected from various oil presses throughout the Republic was investigated. The results, shown in the following table, indicate a considerable variation in the composition of all the parameters analysed.

Variation in the composition of sunflower oilcake

		Average	Range	CV %
Protein content	%	42,4	31,5 - 50,9	12,3
Oil content	%	6,7	2,7 - 16,1	67,2
Crude fibre content	%	17,0	11,8 - 24,0	22,9
Lysine content	%	1,56	1,07 - 1,83	15,0

It is therefore important to pay due regard to any possible differences in composition when sunflower oilcake meal is used in making up pig and poultry rations.

Reproduction

Specialised means of production are being used to an increasing extent in pig production, and the result is improved performance and particularly growth performance. As a result animals reach baconer mass at a younger age. The selection of replacement gilts usually takes place at baconer mass. In earlier years this was usually the age at which puberty was reached. The standard recommendation for the first covering of gilts was that it should take place at the age of seven months and a mass of 100 kg, during the third oestrus after puberty. With the improved growth performance baconer mass is sometimes reached as early as 150 days. Therefore, if the old recommendations are followed, replacement gilts will be unproductive for up to two months. Puberty is linked to age; earlier covering therefore depends on the induction of puberty.

A survey study undertaken by the Animal and Dairy Science Research Institute involved the examination of the genitals of baconer gilts at

abattoirs. The object of the survey was to ascertain whether there is a seasonal influence on the reaching of puberty, to determine the percentage of animals that reach baconer mass before the age of 160 days and to gain insight into the reproduction status of gilts.

The following trends have been observed so far:

There seems to be a seasonal influence on the percentage of animals that reach puberty.

Anatomical abnormalities remain between 1 and 2 %.

From the number of ovulations observed, the left ovary seems to be the more active.

Promotion of production

Pig extension played a prominent part in the activities of the pig sections at both Elsenburg and Irene. The annual short courses were attended by approximately 180 and 150 people respectively. The distribution of pamphlets to farmers on the housing of the sow and her litter and the growing pig was one of the most important activities of the pig industry liaison committee of the Western Cape.

As a result of the drastic increase in feed costs during the past year the staff at Irene had to deal with many enquiries on the formulation of rations. To overcome the problem the computer was used to formulate least cost rations and to make this information available to farmers at regular intervals.

POULTRY

Feeding

In view of the scarcity and high cost of protein-rich feed ingredients, the most attention was again paid to protein requirements. Practical types of laying rations, with as little as 12 % crude protein instead of the usual 15 %, and with only 4,5 % fishmeal, were compared with a commercial ration in respect of the properties that affect egg production. On average 199 eggs per hen were produced on the former ration and 206 eggs per hen on the latter. The supplementation of synthetic lysine in the 12 % ration increased the egg production (204 eggs/hen) and the supplementation of synthetic methionine reduced the average egg production (195 eggs/hen). Statistically the differences were not significant.

The provision of phosphorus is closely related to the provision of fishmeal and a reduction in the fishmeal levels necessitates the supplementation of rations with additional phosphorus to meet the current requirements (0,7 % phosphorus). Trials to determine whether these requirements were not unnecessarily high showed that 0,4 % total phosphorus was sufficient to meet the requirements of laying hens. Although the differences were not statistically significant, egg production, egg mass, feed turnover, Haugh units and shell thickness were better at the lower than at the higher levels (0,5; 0,6; 0,7) of phosphorus.

Breeding

Breeding research is carried out at Irene, Potchefstroom and Glen. The White Leghorn genetic control flock was transferred from the University of Stellenbosch to Glen. The genetic improvement of most strains was, as expected, slight, but some progress was made, particularly when selection for specific characters was carried out. One of the most important problems is the lack of funds, which precludes the evaluation of larger numbers in order to increase selection pressure.

The results of the trials to determine the influence on egg size on the growth of broilers as well as cooking loss in commercial broilers were informative.

Waterfowl

The waterfowl unit was moved during the past year from the Cedara College of Agriculture at Pietermaritzburg to Irene, Pretoria, where all waterfowl research will be carried out in future.

MEAT SCIENCE

Carcase grading

After a survey of the industry in which the qualities of fatness and conformation of cattle carcasses of different grades were described in objective terms, typical carcasses were selected from each grade and then dissected in order to determine the meat yield. Physical, chemical and organoleptical evaluation has been carried out on 84 cattle carcasses out of a planned total of 120.

Points allocated to carcasses by meat graders in respect of fleshing and marketability showed that these properties had higher values in the Super, Prime and Grade 1 carcasses than in Grades 2 and 3. The description of carcasses drawn up by livestock agents for the purpose of catalogue sales showed a similar trend.

As regards subcutaneous fat, it appears that Super and Prime carcasses of comparable masses had approximately the same quality (6 to 7%). The subcutaneous fat percentage of Grade 1 carcasses was 5%, that of Grade 2 carcasses 3% and that of Grade 3 carcasses 2%. These carcasses all came from 0-to-2-tooth oxen (A age group).

The chemical fat percentage in deboned prime rib cuts was found to be nearly the same for Super and Prime carcasses (21 and 23%). Grade 1 carcasses contained 18% fat, Grade 2 carcasses 12% and Grade 3 carcasses 11% fat.

It is therefore clear from these fat parameters that there is much less fat in carcasses of the lower than those of the higher grades. The total edible meat yield showed an interesting trend in that there was about 1% more edible meat in the Grade 3 carcasses than in the Super carcasses. This, however, is because there is less finishing fat in the lower grade carcasses. When the ratio of edible meat (without subcutaneous fat) to bone was studied there was found to be a higher ratio in the higher

than in the lower grade carcasses - in other words a higher bone content in the lower grade carcasses.

The total proportion of expensive cuts in carcasses was between 41 and 42% for all grades - a clear indication that there is no difference in the percentage of expensive cuts between carcasses of various grades.

Cooked meat from carcasses of various grades was given to a panel of tasters for organoleptic evaluation. They found that there was little to choose between meat of the various grades in respect of tenderness, juiciness, flavour and residual connective tissue and that the noticeably large variation in the eating quality of carcase meat found within the same grade was present in all grades.

Meat microbiology

The Microbiology Division of the Meat Science Section at the Animal and Dairy Science Research Institute undertook a survey to determine the influence of slaughter and production lines on the microbiological quality of products leaving a meat factory. In the course of the investigation various points along the slaughter line were studied in addition to the different production lines used during processing, the various products and the packing process.

Fifty pig carcasses were sampled on the slaughter line at three positions on each carcass and at six points along the slaughter line. The sampling positions on the carcasses were on the hindquarter, the breast and the forequarter. Sampling positions on the slaughter line were on the said places on each pig at the following slaughter line points: immediately in front of the singer, immediately behind the singer, after scraping, after evisceration and inspection, after the final washing and after 24 hours of cooling. The agar sausage technique was used and the following were found: before singeing the average counts of mesophyll organisms were very high (over $1,0 \times 10^4$), after singeing the counts were reduced considerably (under 10^2), after scraping slight contamination took place as a result of handling, after evisceration and inspection more contamination occurred, which pushed the count up to about 500 cm^{-2} . The biggest increase took place after the final washing, during which the count increased to about 1600 cm^{-2} , which by Danish standards (500 cm^{-2}) is an unacceptable figure for this technique. The problem is, however, overcome during cooling, when this high count again falls to below 100 cm^{-2} .

After the completion of this first phase, various production lines for processed products were monitored at various points on each line, in order to determine the influence of the various steps in production on the microbiological quality of the product. The production lines for smoked bacon, pork sausages, Vienna sausages, Russian sausages and ham were examined. The findings were mainly the same as on the slaughter line. A

progressive build-up of organisms was found along the production lines. As an example the results obtained for smoked bacon are discussed.

Samples were taken at four points along the line in the same way as in the case of the slaughter line. These points were: (1) immediately after pickling and curing, (2) immediately after smoking, (3) after deboning and (4) after 24 hours of freezing. With the products, as in the case of the slaughter line, mesophylls as well as psychrotrophic organisms were monitored. An increase in the counts of both types of organism was found at point (1).

Because temperatures are low at this stage of production, the counts for psychrotrophic organisms were higher than those for the mesophylls. At point (2) a heat treatment (smoking) is applied, which causes both types of count to drop to below 100 cm^{-2} . The counts of psychrotrophic organisms decreased to slightly below those of the mesophyll organisms because they are more sensitive to heat. During deboning the counts of both types increased drastically to over $1,0 \times 10^4$, which is remarkably high. The counts also remained at that level, even after freezing.

To determine how counts obtained on the production line compare with the microbiological quality of the final products after packing, microbe counts of the final products were also carried out. In this case more accurate methods were used, so that the results obtained by using the fast agar sausage technique could be evaluated. With both methods the highest counts were obtained with pork sausages - a raw unsmoked product.

A few problem areas were identified by means of surveys. These areas included the deboning table, where the smoked bacon cuts are deboned, and the final washing process on the slaughter line. These problems could be overcome through the application of recommendations resulting from this research survey. There are, however, other problem areas that will require attention, such as the high microbe count observed in pork sausages. This should be studied by means of further surveys and research.

WOOLLED SHEEP

Quality improvement through the elimination of quality deviations in the Merino wool clip is being studied by the Karoo Region. It has been found that deliberate selection for higher quality leads to a higher incidence of undercrimping with harmful side effects such as lack of substance, low resistance to matting and a greater tendency to felting. The lack of substance in the wool on the sheep causes a more deep weathering, with the result that up to 30% of the wool fibre length is lost as noils.

According to a survey in the Karoo Region the Merino clip is again showing extensive weathering as a result of undercrimping in the wool produced in various farming areas. Improved

management methods could control the condition effectively.

An investigation into the voluntary intake and digestibility of *Atriplex* species (old man saltbush) by sheep in the Karoo showed that relatively poor material obtained from this shrub can supply 77 to 97 per cent of the maintenance requirements in respect of energy.

The production and reproduction figures of the Merino stud breeding project of Grootfontein are still showing satisfactory progress. The average clean wooll production of the unselected two-tooth ewes was 4,30 kg and that of the unselected two-tooth rams 7,03 kg for the 1978 season. The weaning percentage was 124 per cent.

A selection trial in which clean wool mass determination and the hand and eye method were compared with an unselected control group has shown that there is a positive response in the clean wool mass with a higher selection differential than with other groups.

A two-way selection trial for particular fleece properties such as wool quality and wool oil has shown that wool from the oil-plus group contains 3 to 4 times as much wool oil as wool from the oil-minus group. Selection for poor quality has also shown progress in that the wool properties deteriorated.

The investigation into fat lamb production from old Merino ewes was continued in the Free State Region. It was found from a group analysis that it is uneconomic to provide more than 13% crude protein after a body mass of 20 kg has been reached.

At the Nooitgedacht Research Station rams of breeds that produce white wool were crossed with Merino ewes. Half-cross ram lambs were found not to be ready for marketing at a live mass of 35 kg. Where the white-woolled half-crossed ewes were covered by mutton rams of a recognised white-woolled breed, slaughter lambs with good marketable carcasses at 35 kg live mass were obtained. In the reciprocal crossings special attention will have to be given to the processing potential of the wool.

At Athole, the Nooitgedacht experimental farm, it was found that multiple lambing seasons can be applied successfully. In comparison with a single annual lambing season, where the fecundity was 119%, a multiple lambing season produced a lambing percentage of 149. In addition, 25% more lambs were born, 70% more lambs were weaned and 89% more meat was produced than in the case of a single lambing season.

A survey of the wool production potential of the crossbred progeny of certain white-woolled breeds is being carried out by means of skin histological examinations at the Animal and Dairy Science Research Institute. The ratio of secondary to primary follicles (S/P ratio) and the accompanying density per unit area are being examined on a comparative basis. Judging by these criteria, some breeds benefit more from crossbreeding than others. For example, the S/P

White-woolled rams							
Breed	^a Merino	^a Merino-landrace	^a Finnish landrace	^a Texel	^a Border Leicester	^a Bleau de Maine	^a Cheviot
Crossing	^b Merino	^b Merino	^b Merino	^b Merino	^b Merino	^b Merino	^b Merino
S/P ratio	24 ^a 22 ^{ab}	7 ^a 16 ^{ab}	7 ^a 9 ^{ab}	5 ^a 9 ^{ab}	4 ^a 10 ^{ab}	4 ^a 11 ^{ab}	4 ^a 12 ^{ab}

ratio of the Cheviot trebled after the crossing (4:12), with a corresponding increase in the follicle population, while the Finnish Landrace showed less improvement (7:9). The following table reflects the trend in the increases.

A research programme consisting of accelerated breeding (8-month cycles) on artificial pastures has been launched with Dohne Merinos on the Bathurst experimental farm in the Eastern Cape. The most important pastures are kikuyu, Rhodes grass, *Eragrostis curvula* and *Cenchrus ciliaris*. Preliminary observations show that owing to its germination properties and growth habit, *Cenchrus ciliaris* (buffel grass) is not a suitable source of feed for such an intensive slaughter lamb production system. The weed *Galenia pubescens* is a fundamental problem in the establishment of most grasses.

PELT SHEEP

The decline in Karakul prices which set in during the previous year continued during the year under review. The average price for black pelts

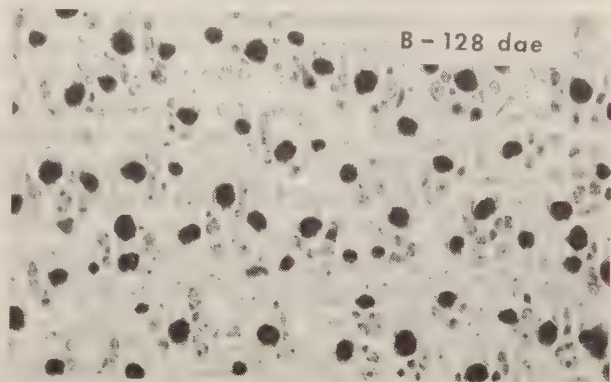
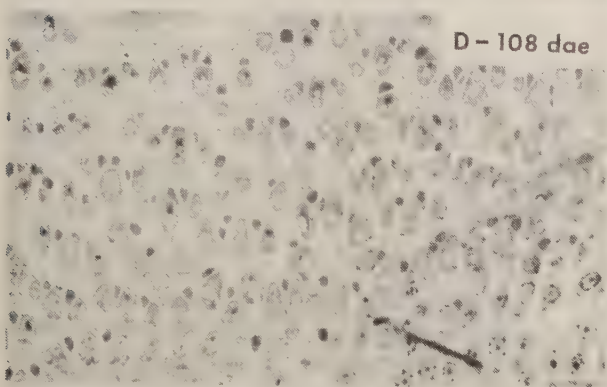
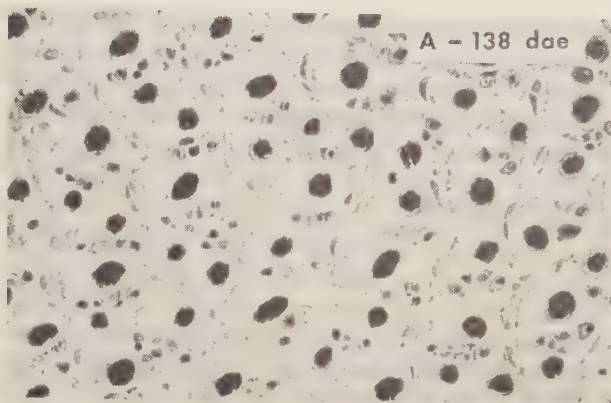
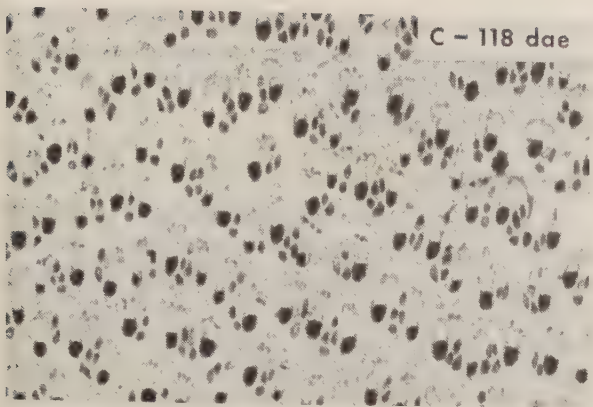
dropped from R13,39 in May 1977 to R10,44 at the 1978 May auction. The price of grey pelts sold by the same brokers dropped by an average of R3 per pelt during the corresponding period. The average price of grey pelts at this stage was nevertheless about R6 higher per pelt than that of black pelts. The drop in pelt prices may be ascribed chiefly to the fact that the demand for long-haired pelts such as mink and fox has risen at the expense of SWAKARA. Nevertheless, good quality Karakul pelts still fetch high prices. It appears that more attention will have to be paid to quality improvement in future, and in particular to the improvement of hair quality. Clearly, producers will also have to concentrate to a far greater extent on breeding one of three colour types, namely grey, white and brown.

Breeding

With regard to Karakul breeding research, it is clear from a project at the Upington Karakul Research Station that is already producing fourth



Research has proved that the weathering of wool can be greatly limited by providing shade



Skin sections of Karakul foetuses. The follicles with black fibres are clearly visible. Note the difference in size of the fibres at the various ages of foetuses

generation progeny that selection for decrease in curl type is extremely effective. Progress with selection for this property has been almost twice as great in the fourth generation as in the case of any of the other three properties for which selection is being applied, namely hair length, pattern and hair quality. Determinations of hair thickness in the same project indicate that thicker hairs ($38,28\ \mu$) have been found, especially in the pattern line, but that the hairs in the hair quality line are considerably thinner ($34,38\ \mu$). An interesting finding is that hair thickness was lowest in the control line where no selection has been carried out for about 15 years ($33,97\ \mu$). Selection for twinning is showing results: 10 % twins were born in this fertility line as against 2,1 % in the control line.

Efforts are being made to develop a chocolate brown pelt with light hair tips, and it has been clear for some time that the light hair tips on the brown pelts are the main factor in determining the price. Heritability estimates have now shown that this character is highly heritable ($h^2 = 0,472$). In view of its high heritability and its economic value, this character should be emphasised in any breeding plan for brown Karakuls. It is also clear from matings of chocolate brown rams and chocolate brown ewes that this colour occurs in about 50 per cent of the progeny. The undesirable rust brown colour does occur in 25 per cent of the progeny, however.

The development of pelt colours in South-West Africa is still progressing satisfactorily. Attempts are being made to increase the numbers

of white and grey sheep considerably. A reciprocal cross-breeding programme for the white pelt colour has been started with dominant and recessive animals. As soon as sufficient F_1 material is available, breeding will continue with the original flocks. There is considerable interest in a white group breeding scheme at present and the Department helped launch the scheme.

The development of the coat in the Karakul foetus is being investigated for four curl types (pipe curl, developed shallow curl, shallow curl and watersilk). The ratio of the primary to the secondary components of the follicle group can only be determined from 108 days prenatal, although both types of follicles are visible considerably earlier in the development. As may be expected, there are significant increases in primary and secondary follicles for all four curl lines from the ages of 108 to 138 days prenatal.

There is a higher primary and secondary follicle increase in the pipe curl than in the other three types and it may be concluded that development is faster here.

In the sheep, as in other mammals, the first follicles appear in the facial skin and as the foetus grows older the follicles spread backwards to the tail and downwards to the belly and extremities. In the case of other sheep the primary follicles mainly appear as trio-groups and this grouping is striking in the Karakul. It appears at this stage of the investigation that the shoulder area develops more rapidly than the tail area below the rump. This is evident both from the larger follicles and fibres and

from the higher number of secondary fibres. The coat is less dense in the shoulder than in the rump area, as a result of skin and fibre growth. Other positions are also being compared for an evaluation of the development process.

Reproduction

A project in which oestrus synchronisation was investigated with the aid of intravaginal sponges and pregnant mare serum in lactating Karakul ewes at the Upington Karakul Research Station has been completed. The most important observation that resulted from this project is that the oestrus period of lactating ewes is highly significantly shorter than that of non-lactating ewes. Oestrus periods were also shorter in ewes where synchronisation was started 28 days *post partum* than in the 38 and 48 day *post partum* groups. Ovulation was normal and occurred immediately before or after the end of oestrus in all groups. Nevertheless, lambing percentages show that lactating ewes have a far lower rate of impregnation than non-lactating ewes. Poorer lambing percentages were also found in the earlier *post partum* groups.

In a study in which two methods of synchronisation, namely the use of intravaginal sponges and the use of subcutaneous silicone rubber implants, were compared for effectiveness with Karakul ewes during the breeding season and anoestrus, it was found that the period from the withdrawal of progestogen to the start of oestrus is highly significantly shorter in the case of the implant. The ovulation rate and the lambing percentage were not affected by the progestogen treatments. Average lambing percentages after artificial insemination during anoestrus were 86 and 75 per cent for the implant and sponge groups, respectively. Only in one respect is the implant more effective than the sponge as a method of synchronisation - it provides better synchronisation of the oestrus response.

The Karakul and the southern part of South-West Africa are synonymous. The economic basis of Karakul farming is exceptional in that it is possible to run a Karakul enterprise on a sound economic footing even during bad years. In other words, the ecological interaction and conditions are practically ideal in respect of optimum resource development. Research is aimed largely at optimum reproduction, with the emphasis on quality. The covering seasons project at the Kalahari Research Station, where an average lambing percentage of 160 % has been maintained over the past five years, is making a notable contribution here. In addition, attempts are being made at several research stations to increase reproduction efficiency by means of earlier mating of young ewes. It was found at Neudamm, with autumn lambs, that if mating takes place at a year instead of 18 months an additional 0,97 of a lamb per ewe will have been produced by the age of three. In a similar project at Gellap Ost, where spring lambs were mated at 7 months and

then included in the main mating season again (April/May and October/January), lambing percentages of 80 % and 72 %, respectively, with a total of 152 %, resulted.

Pelt marketing

A project at the Upington Karakul Research Station in which pelts that were not washed before spreading out were compared with pelts washed in the conventional way has been completed. No significant differences were observed in respect of pelt mass, pelt area, pelt thickness, hair length and pelt prices. However, curl development increased significantly from the lamb to the pelt as a result of the washing process. Friction resistance tests carried out by the Leather Research Institute show that this method of curing does not affect the wearing qualities of the final product. The dry curing method is a useful alternative during periods of high humidity, when pelts are difficult to dry and conditions are conducive to bacterial rot.

ANGORA GOATS

An investigation into the influence of cold on abortion in Angora goats has shown conclusively that cold has no effect on abortion, probably because the ewes succumb too soon. Adult pregnant animals has a better resistance to cold than young non-pregnant ewes. It is evident that cold stress produces considerable physiological and endocrinological changes in the Angora goat.

The abortive effect of prostaglandin secreted by the womb was also studied. Pregnant Angora ewes were given intramuscular injections of a synthetic prostaglandin and they all aborted between 47 and 58 hours after the treatment. Determinations of the plasma progesterone concentration indicated that the progesterone level dropped by over 50 per cent after four hours and reached base level after 14 hours. The findings are in line with earlier theories that prostaglandin plays an important part in the incidence of abortions following poor feeding of pregnant ewes.

Seasonal variations in adrenal and thyroid function have been found in Angora rams and ewes upon analysis of the levels of corticosteroids and thyroxine in the peripheral plasma. Even with pronounced fluctuations, the level of corticosteroids tends to be highest in autumn. The levels of both hormones were significantly higher in the ewes than in the rams.

A study on the effect of the level of energy and protein feeding on perinatal losses, lactation and growth of lambs in Angoras produced interesting data. Energy levels had a significant effect on the length of pregnancy, udder development and average daily milk production.

The various levels of energy and protein intake had a significant effect on the growth capacity of ram and ewe lambs from the age of four weeks up to and including the age of 16 weeks.

Raw hair production was significantly influenced by various protein and energy levels and fibre thickness was also affected by the various protein levels.

DAIRY CATTLE

Feeding

A study of the nutritional value of sodium hydroxide-treated wheat straw for lactating cows is in progress at the Elsenburg College of Agriculture. A considerable amount of time has been spent on finding a practical and scientifically correct method of administering caustic soda. Up to now researchers have concentrated mainly on a "dry" method (using a feed cubing machine). Since the results obtained so far do not come up to expectations, it is intended to investigate alternative methods (semi-dry and wet methods) as well in future.

The use of sorghum hay, mixed in various proportions with concentrates as a complete ration, fed *ad lib.*, for the economic production of milk was investigated at the Glen College of Agriculture. The crude protein content of the three rations was equal (13,4 %) but the metabolisable energy content varied from 9,68 to 7,63 MJ/kg. The proportions of sorghum hay (S) to concentrates (C) fed were 20S : 80C, 40S : 60C and 60S : 40C. The highest margin above feed costs was obtained with the 40S : 60C ration in the case of the more productive animals. With less productive animals the 60S : 40C ration is recommended. From the point of view of metabolisable energy intake, production and economics, the 20S : 80C ration cannot be recommended for dairy cattle.

Several digestibility studies with steers carried out in the Natal Region indicated that the nutritional value (TDN and DCP) of kikuyu is correlated with milk production only during the spring months. During summer and autumn milk production decreases progressively but the nutritional value remains fairly constant. The TDN values obtained from digestibility studies varied between 64 % and 61 %, and the values calculated from grazing trials and from milk production lay between 63 % and 57 %. The fluctuation in the TDN values as determined by digestibility studies is not related to the season of the year.

It was established in the course of an investigation carried out at the Animal and Dairy Science Research Institute on the evaluation of milk surrogates for calves that simple tests such as sedimentation and *in vitro* "DM digestibility" could be useful in evaluating milk surrogates. It may be deduced from the results that these simple tests have a good repeatability and that there is probably sufficient variation between various milk surrogates for meaningful evaluation.

The project is continuing with an *in vitro/in vivo* comparison.

The computer programme for determining the quantity of concentrates to be fed on the basis of the level of production, butterfat percentage and

the energy level of roughage and concentrates underwent further development at the Cedara College of Agriculture. The minimum quantity of protein required in the concentrates to balance the energy requirements can now be indicated. Nutritional charts for the commonest farm situations were prepared by means of the programme for both Friesians and Jerseys.

Reproduction

It has been found in the Natal Region that the success of conception is determined by the daily body mass increase of heifers during the synchronisation period and the period immediately following mating. A conception rate of 80 % was obtained after the first insemination when the daily body mass increases were 0,74 kg, whereas the conception rate was only 42 % where the mass increase was 0,14 kg.

Extension to the dairy industry

Officers of the Animal and Dairy Science Research Institute were the speakers at nine dairy farmers' days and two symposia. Forty-five visits were paid to farms in connection with feeding problems. A liaison committee for the dairy industry was established in the Winter Rainfall Region during the past year. The committee comprises officers of the Department, farmers and representatives of the private sector. The Natal simulation model for dairy cows developed at the Cedara College of Agriculture is being used by 80 dairy farmers in Natal at present.

DAIRYING

Milk

The testing of five different automatic samplers for the bulk handling of milk revealed that the relative carry-over effect of bacteria from one sample to another is in the order of 0,2 % - a very low value. The investigation, which consisted of several bacterial tests, also revealed that slightly higher bacterial counts are obtained as a result of the pump effect. It also showed that slightly shorter methylene blue and resazurin periods are obtained. It was found that the influence of some of these samplers on the relative carry-over effect of fat and proteins may be considerable in the case of fat. In the case of proteins the carry-over effect was insignificant. The investigation emphasised that these automatic samplers have to be handled by trained persons and treated with great care if good representative samples of milk supplied by a particular producer are to be obtained.

The efficiency of milk metering systems was tested in co-operation with the Division of Agricultural Engineering, chiefly in order to determine the efficacy of air separators, since the positive displacement meters also react to incorporated air and register it as volume of milk. All the systems tested functioned efficiently and registered within the permissible error of 0,5 %.

The keeping quality of perishable dairy products, which included pasteurised milk and cream, yoghurt and cottage cheese, showed that poor keeping quality is due chiefly to infection after pasteurisation. Of a total of 220 spore-forming bacteria isolates from ultra-high temperature treated (UHT) milk, puddings and sterilised milk, 110 isolates were identified as spore-forming *Bacillus* species. The percentage incidence is given in Table 1.

TABLE 1 - The incidence of *Bacillus* species in ultra-high temperature and sterilised milk

Species	% incidence of <i>Bacillus</i> spp.		
	UHT milk	UHT puddings	Sterilised milk
<i>B. cereus</i>	48,6	7,6	21,7
<i>B. licheniformis</i>	13,5	46,1	30,4
<i>B. pumilis</i>	12,1	15,3	17,3
<i>B. subtilis</i>	13,5	30,7	8,6
<i>B. coagulans</i>	5,4	0	0
<i>B. polymyxa</i>	2,7	0	0
<i>B. megatherium</i>	2,7	0	0
<i>B. circulans</i>	1,3	0	4,3
<i>B. stearothermophilus</i>	0	0	13,0
<i>B. alvei</i>	0	0	4,3

Some of these species are capable of withstanding temperatures as high as 140 °C for five to 10 seconds. The presence of non-spore-forming bacteria is indicative of post-pasteurisation contamination. Recommendations in respect of management, control and packing could therefore be made.

In view of the national importance of milk proteins and the potential shortage of such proteins, the amino acid composition and quality are being studied. Emphasis is being placed on the whey protein fraction (albumin and globulin) and its genetic basis in dairy cows. A comprehensive amino acid pattern is being determined for each fraction and the following findings are of importance:

1. The fraction composition and quantity of whey proteins in milk obtained from various cows differ.
2. The lactalbumin, which is the biggest source of sulphur-containing cystine, represents up to 30 % of the whey protein.
3. It would appear that the cow has an individual pattern in respect of whey protein composition and quantity.

A method of analysing amino acids by means of gas chromatography has been developed, with the result that a large number of samples could be dealt with.

The determination of the milk fat content of milk by random testing three times a month does not reflect the true fat content of the producer's milk. Over longer periods (6 tests or more) good correlations are obtained, but at this stage it appears that daily composite samples are the ideal system. By using a running average over a period of two to six months a correlation within 0,2 % to 0,1 % of the correct value can be obtained.

Problems with the stability of milk proteins were encountered at various centres; ultra-high temperature treated milk and special milk foods for children (e.g. humanised milk) caused the most problems. Although excessive heat treatment and a mineral imbalance were the cause of instability in many cases, there were strong indications of enzymatic breakdown of the milk proteins during cold storage. These enzymes come from psychrophilic bacteria and have a high resistance to heat. A reliable heat stabilisation test has been developed and further research is planned.

Cheese

Two matters that had been causing cheese-makers concern were the influence of pre-ripening of the milk and the effect of certain streamlined procedures on the quality of the cheese. The omission of pre-ripening did not noticeably reduce the manufacturing period, and pre-ripening did result in a reduction in the thermophilic bacteria and the more rapid breakdown of proteins during ripening. The omission of the Cheddar process, three variations of which are used, yielded a poorer quality Cheddar cheese throughout. The addition of the β -galactosidase enzyme reduces the manufacturing period and produces faster ripening. However, the cost of this enzyme does not yet justify its commercial use.

The typical taste and flavour that should be present in mature cheese are often absent. An investigation revealed that storage temperatures during ripening are too low in most of these cases, with a consequent delay in the breakdown of proteins. A comprehensive programme to investigate the causes of delayed breakdown of proteins in cheese, and ways of accelerating breakdown, is being undertaken.

The cheese starter programme included the building up of the present collection of starter bacterial strains, of which there are already about 80, and their maintenance. Extension to cheese factories and studies of transplantation techniques also take up a major part of the programme. Starter cultures can be preserved by freezing at -10 °C for 50 days without any change in the properties or any significant loss of activity. This reduces the chances of contamination in comparison with daily inoculation; it saves time and furthermore at least two bacteriophage-unrelated starter cultures can be kept in reserve. An investigation into the composition of commercially available starter cultures showed that *Streptococcus cremoris* is the dominant species. A few years ago it was *S. diacetylactis*.

Studies on the recovery of whey proteins and the utilisation of whey, inter alia through ultrafiltration, were completed in the course of the year. The work involved the following:

1. The development of rapid and reliable methods for the determination of proteins and lactose which can be applied for control purposes in the course of ultrafiltration.

2. The determination of suitable products to be manufactured by factories and the techniques required. It is recommended that a product with the same composition as skim-milk powder should be manufactured, except that it should have a far higher nutritional value. Pure lactose could be prepared from the filtrate after crystallisation and demineralisation. At present about 3 400 tons of lactose and demineralised whey powder are imported.
3. Research on the enzymatic conversion of the ultrafiltrate (lactose) to glucose/galactose, which is a more acceptable product to the ice-cream and sweets industries.
4. The development of a simple technique for separating and recovering whey proteins through denaturation. The addition of 3,0 g of denatured whey proteins to one litre of milk produces an increase of 4,4 % in the cheese yield, with no decrease in the quality of the cheese.

Cheese has been made with the aid of ultrafiltration, but certain defects, such as poor consistency, are still being investigated. The pattern of the mineral balance of milk that has been subjected to ultrafiltration is being studied in this regard.

Gas formation in cheese is generally due to coliform, heterofermentative lactobacilli and butyric acid producing bacteria. Aerobic spore-forming bacteria have been isolated; one of them does not form gas after aerobic growth but does so under anaerobic conditions. These bacteria are being identified and their characteristics studied. This includes determining possible sources of contamination. A study on the taxonomic, physiological and morphological properties of propionic acid producing bacteria is being undertaken and the importance of such bacteria in cheese making is being investigated.

Butter

Cultured cream butter (aroma butter) is manufactured on a regular basis at the experimental creamery at the Institute. The temperature treatment procedure for the crystallisation of the cream recommended for this type of butter produces better spreadability than is obtained when butter is made in the conventional way. Strict standards have been laid down, chiefly to avoid the possibility of oxidation defects and rancidity. In the course of the year there were indications that copper contamination in butter - the cause of accelerated oxidation of the fat - has already decreased considerably.

Concentrated products and other dairy products

In the course of a survey on the incidence of *Bacillus cereus* in milk powders it was found that this organism is not a potential source of food

poisoning because of the low numbers in which it occurs. A selective nutrient medium for indicating the presence of *Clostridium tyrobutyricum* in milk powders and other dairy products was developed. There is a very low incidence of these bacteria in South African dairy products and research to determine the inhibiting effect of the antibiotic Nisia on the bacteria is proceeding.

A continuous method of measuring the density of concentrated milk products during concentration by the single vibrator tube system has been tested. This system, which has certain advantages over conventional systems, is accurate and very adaptable for remote operation and automated systems.

Following several inquiries into the contamination of magou by yeasts and problems with obtaining a suitable magou starter, certain matters were investigated. By mixing wheat flour with a sterile filtered extract of wheat bran and adapting *Lactobacillus delbreuchii* to sour the maize meal mixture, these problems can be overcome. The addition of skim-milk increased the rate of souring so that the wheat meal extract could be omitted, since it produced no additional stimulation.

Dairy auxiliary services

Quality improvement laboratories

The objective judging and thorough analysis of dairy products, with the necessary *in situ* investigations and advice to the factories concerned, are carried out chiefly from Irene and to a lesser extent from Glen and Elsenburg.

In the case of butter there were found to be considerable differences between subjective and objective judging. Judged subjectively, 90 % of the samples complied with the standard on reception. Judged objectively, the corresponding percentage was 40 %. When the keeping quality was determined the values were found to be 75 % and 15 % respectively. The copper content of the butter has decreased and complies with the required standard at present. The decrease can be ascribed to the large quantity of fresh cream a number of creameries are receiving at present. The control of the pH at factories is improving but some factories are still having considerable problems with moisture distribution. The number of samples that met the bacteriological standards also rose. The quality of a considerable quantity of export butter was checked on behalf of the Dairy Board in accordance with overseas specifications.

Cheese - mainly export cheese (2 600 samples) - was analysed on behalf of the Dairy Board for the manufacture of processed cheese. This cheese was tested for the presence of butyric acid forming organisms and *Clostridium* spore-formers. The presence of these organisms is undesirable in the manufacture of processed cheese, since it can cause gas formation at very high temperatures (>30 °C). At some cheese factories up to 40 % of the samples were positive for these organisms.

The samples of powdered milk analysed attested to good moisture and fat control at the factories concerned. With a few exceptions the total count per ml complied with the standards.

The laboratory receives ultra-high temperature-treated milk samples daily for quality determination. Very few of these samples are rejected on bacteriological grounds. When organoleptic judging was applied some of these samples were found to have a burnt taste, and a bitter taste was present in a few samples.

There were no coliform organisms present in the samples of pasteurised milk received. The spore count per ml (aerobic and anaerobic) varied from 0 to 100, the total count per ml from 30 000 to 500 000 and the psychrophilic count per ml from 0 to 4 000. Chemical analyses showed that fat oxidation had been kept to a minimum.

Training of dairy technicians

Technicians for the dairy industry are trained at the Glen College of Agriculture. A course on dairying is presented as part of the course for the National Diploma for Technicians. The following subjects were offered during the year under review:

Introductory course for the Dairy Diploma, Cream grading, Cream testing, Methylene blue test, Milk testing and Courses on the handling of equipment for determining fat in milk by the light scattering method.

At Elsenburg short courses and lectures on dairy science covering a broad spectrum of subjects are presented to dairy technicians at factories; agricultural diploma students are given lectures on milking and dairy product manufacture.

Extension

Following results obtained in the quality improvement laboratories, factories experiencing or anticipating problems were visited on a regular basis and advice was supplied. Powdered milk factories experienced problems mainly with the solubility of their products. Gas formation in cheese and inactive starters were the chief difficulties at cheese factories. The presence of inhibitors in the milk of suppliers was a cause for concern at some factories and tracing was carried out and recommendations made on screening tests.

A number of the problems experienced with the heat stability of milk proteins were attributable to a mineral imbalance in the milk or to excessive heat treatment. In certain cases other factors are involved and further research is planned.

About 30 meetings of milk producers who are directly involved with purchasing milk on a quality basis were addressed by dairy officers at Elsenburg. The subjects included the purchasing of milk on a quality basis, the handling of milking machines and the cleansing of milking equipment. A successful cheese starter symposium was arranged for the cheese industry during the past year. It was exceptionally well attended. Officers were also

involved in a symposium on individual dairy extension.

The milk testing laboratory of the Institute dealt with 11 500 cows under the milk recording scheme - a considerably larger number than the previous year. As in the past, the inclusion of the lactose percentage in the milk analysis was appreciated by milk producers because of the exceptional value of this information in the mastitis campaign. The number of cows is expected to continue to increase, although not as rapidly as during the past few years.

MISCELLANEOUS

Horses

Visitors (both local and overseas groups) again showed great interest in the Percheron Stud at Elsenburg. Five foals were born from the 11 breeding mares and 10 mares belonging to farmers were covered by Elsenburg stallions.

After 20 years of breeding the Nooitgedacht ponie has been approved for affiliation to the SA Stud Book Association - the first South African breed to have been accorded this honour. Since a strong breeders' society has been established for the breed, it has been possible to wind up the breeding project at Nooitgedacht by auctioning the parent stud. The highest individual prices obtained were R875 for a stallion and R1 225 for a mare.

Ostriches

Research on ostriches is conducted at the Oudtshoorn Experimental Farm. The effect of the length of the storage period on the hatchability of ostrich eggs was studied and it was found that it is not worth storing eggs for over 15 days under artificial conditions.

An investigation into the high percentage of dead-in-shell ostrich chicks showed that hard and malformed shells, abnormal lying positions adopted by the chicks and malformed chicks are important factors.

An investigation into the high percentage chick mortality under general farming conditions revealed that most problems could be avoided with good management practices. Unfavourable temperatures, poor ventilation in the sleeping quarters and, especially, underfeeding during the first 8 to 14 days contribute to high mortality.

There are indications that the failure of plumes to unfold, a "disease" which has been causing concern, could be a recessive character which is emerging as a result of severe inbreeding. Preliminary results indicate that the number of wing plumes in ostriches has a very low degree of heritability.

The skin yield of an ostrich is closely correlated with live mass. Preliminary indications are that the suppleness of ostrich leather decreases as the slaughtering age rises above about 21 months. Feather follicle development on tanned skins increases in proportion to age.

Preliminary results of an investigation into the effect of grazing by ostriches on lucerne showed that such grazing is undoubtedly harmful. The feeding of chopped lucerne has big economic advantages over direct grazing.

SUPPORTING RESEARCH

Blood group laboratory

The Blood Group Laboratory at the Animal and Dairy Science Research Institute produced 18 reagents during the year. The laboratory was to have participated in the international standardisation trial, but unfortunately Moscow, which arranged the trial for 1978, probably overlooked the laboratory. The number of reagents used in this country in the blood typing service already amounts to 45. During the past year 3 893 blood specimens were tested, which is 255 less than during the previous year. These included 459 parentage cases, in 95 % of which it was possible to give a verdict, 34 pairs of bull-heifer twins, where four heifers were declared fertile, and the blood typing of 2 514 breeding bulls. Thousand calf control tests were carried out on 108 calves from various breeds.

The *chromosome studies* in the cytogenetic laboratory have reached an advanced stage in respect of the routine karyotyping of all AI bulls. The results with regard to chromosomal aberrations (such as translocations, inversions, deletions and numerical aberrations) will now be investigated for a possible link with fertility aberrations such as low conception figures. Apart from the techniques for G and C band patterns, by means of which individual chromosomes and chromosome segments can be identified in chromosomal aberrations, techniques for Q band are also in use now. All Bonsmara bulls from the State herd are examined for chromosomal aberrations before being sold at the annual auction. No abnormalities have yet been found among these bulls.

SPF status (specific pathogen free) has now been maintained in the *animal breeding laboratory* of the Small Stock Unit at Irene for about two years. This is due partly to the strict hygienic conditions under which the staff work in the unit.

All feed, cages and bedding are autoclaved before being brought into the unit. The air supply is passed through an absolute filter and is standardised in respect of temperature and moisture. This ensures healthy, strong litters.

An ideal and standardised biological model is made available; maintenance costs are far lower than for a large farm animal.

In this way large numbers of animals can be accommodated within a reasonable period in a selection experiment involving a number of generations.

At present there are a Wistar outbred rat line and an HaICR outbred mouse line. A Balb/C line without the "nude" gene has been bred from the original inbred Balb/C mice with the "nude" gene. The "nude" gene was transmitted by means of

crossing to HaICR mice, which are far stronger, so that a better production of "nude" mice is ensured.

Since the "nude" mice have no thymus gland, they are very valuable in immunological work and cancer research.

Important results were obtained in the field of *biochemical genetics* in connection with haemoglobin in cattle. This protein occurs in various genetic forms, a fact which is useful for investigations such as paternity determinations. It was possible to prove beyond any doubt with the aid of several electrophoretic techniques that the C band in Brahmans differs from that in all South African breeds (such as the Africander, Bonsmara, Drakensberger, Bapedi, Nguni, Mashona and Tuli). This band, which was erroneously called a C band, has now been renamed I. The frequency of I is considerably higher than that of C, with a value of about 0,1. The frequency of B in Southern African breeds is also low (the average value is about 0,1), but A, with a frequency of about 0,8, is relatively high. In Brahmans, on the other hand, the frequencies of A and B are equal, and C is only 0,008.

These results are important in paternity determinations and in gaining an understanding of the historical development and distribution of cattle throughout the world.

Nitrogen utilisation by ruminants

The effect of the level of feed intake on the efficient utilisation of protein sources by ruminants is being studied at the Animal and Dairy Science Research Institute at present. This work has become urgent as a result of the large-scale elimination of fishmeal from ruminant rations and the attempt to find alternative protein sources without sacrificing production efficiency. After initial difficulty in finding suitable experimental animals, the problems with technique have been ironed out and studies on the utilisation of oilcake meals are now being carried out.

An investigation was carried out at the Animal and Dairy Science Research Institute to determine how much more protein could be saved with a gelatinised starch urea complex than is saved with ordinary non-protein nitrogen sources such as urea. Although these products are less toxic than urea, they showed no real advantage over urea with regard to protein saving.

Feed utilisation by ruminants

There has been considerable progress at the Animal and Dairy Science Research Institute with the improvement of techniques for obtaining reliable estimates of the voluntary feed intake of animals on various kinds of feed and pastures from laboratory data. This work included a project in which the voluntary intake of sheep on widely divergent feeds such as wheat straw, buffalo grass, lucerne hay and maize straw was successfully estimated with great accuracy. Researchers are now

working on adapting this technique for the industry.

Research at the Animal and Dairy Science Research Institute on the utilisation of kikuyu pastures has now removed all doubt that the performance of animals run on such pastures is lower than feed evaluation techniques would normally indicate. This lower performance is the result of very low pasture intake by grazing animals. The causes of unsatisfactory intakes are still being sought, to determine whether practical methods for correcting the problem can be developed.

The chemical treatment of low-grade feeds

A programme for treating low-grade feeds and waste products with caustic soda and other promising chemicals and investigating the effect on ruminant production was launched at the Animal and Dairy Science Research Institute. Most of the findings were subsequently announced at an Information Day held at Irene during May. The work was summarised in a brochure which is obtainable from the Division of Agricultural Information.

The most important findings may be summed up as follows:

1. A caustic soda treatment at a concentration of 5 % appears to be optimum for most purposes.
2. The metabolisable energy (a criterion of usable energy) obtained from low-grade feeds such as maize straw, wheat straw, bagasse, poor weeping love grass and winter veld grass improved from 40 %-50 % to 60 %-70 %.
3. All grass species respond to a greater or lesser extent to caustic soda treatment. However, the digestibility of lucerne and other legumes does not change.
4. The voluntary dry matter intake of feeds that have been treated with caustic soda increases by between 35 % and 80 % and that of metabolisable energy by between 65 % and 150 %.
5. As a result of the increased intake, growth and feed conversion improve considerably. In one trial with lambs in which weeping love grass was used mass increases varied from 79 g per day on the untreated product to 213 g per day on the product treated with 5 % caustic soda. Feed conversions were 15,3 kg and 7,6 kg of feed per kg of mass increase respectively.
6. Studies of the digestive tract showed that when kikuyu that had been treated with caustic soda was fed twice as much energy and amino acids were absorbed as in the case of the untreated product. When treated kikuyu hay is fed on its own, potassium, cobalt and zinc have to be supplemented to the prescribed levels, and sulphur to the level of one unit of sulphur to five units of nitrogen in order to ensure a satisfactory intake.

7. The period for which feeds treated with caustic soda remain in the rumen of the ruminant is considerably less than in the case of the untreated product. If the digestibility as measured in the laboratory is over 70 % after treatment, the extent to which the feed can be utilised decreases, because the feed is not exposed to the fermentation of the rumen micro-organisms for long enough.
8. Caustic soda-treated low-grade waste products such as bagasse and sugar-cane tops may constitute up to 50 % of the growth rations for lambs and up to 75 % of the maintenance rations, provided crude protein and minerals are supplemented.
9. A ration containing 72 % caustic soda-treated wheat straw was as successful as a growth ration for lambs in terms of mass increase and feed conversion as one that contained 50 % maize meal. Although the lambs fed on the first ration contained less total fat, this did not apply to subcutaneous fat, so that grading could be expected to be the same. Feed costs are R14 per ton less for the 72 % treated wheat straw ration than for the maize meal-based ration.
10. Successful wet storage of caustic soda-treated feeds is possible if 1 % formalin is used.
11. Preliminary results with ammonium hydroxide instead of caustic soda show that the digestibility of wheat straw can be increased from 40 % to 60 % and the voluntary dry matter intake of lambs by 15 %.

Breed evaluation in respect of the efficiency of feed consumption

Two important matters complicate accurate and comprehensive breed and animal evaluation for efficiency of feed consumption: minor differences between breeds and animals and the fact that the order of breeds and animals may vary depending on the stage at which comparisons are made. The former problem necessitates accurate measurements in order to quantify the differences and the latter problem underlines the importance of drawing comparisons over a long growth interval. In both cases a suitable mathematical model can be a valuable aid.

Since a generally applicable model did not exist, one was developed empirically at Irene and intensively evaluated with the aid of sheep growth data. The model appears to be suitable in that it meets the following requirements:

1. It describes growth curves accurately.
2. Mathematical interpretation is easy.
3. The model is based on biological principles.
4. It is able to predict growth.
5. It makes extensive comparisons between animals and breeds possible.
6. It describes the growth process in terms of energy supply and consumption.

The following interesting matters were revealed by the investigation: SA Mutton Merinos

were more efficient than Karakul ewes when comparisons were made at the same age or mass, but the opposite was true when comparisons were made at the same fat percentage. Sheep that ate 80 % of the calculated voluntary intake utilised their feed as efficiently as sheep fed *ad lib*. Measurements that appear to be important in determining the growth efficiency of breeds or animals are mass increase, feed conversion and fat content of the animal body; feed intake appears to be less important.

Standards for livestock units

Work on the replacement of large stock and small stock units by more realistic standards of comparison has advanced so far that a proposed new system has already been drawn up by the Animal and Dairy Science Research Institute. This system fits in with the international system of units and is at present being considered by various Departmental bodies from the point of view of practical acceptability.

General

Facilities for cattle dipping

Plans for a dip tank and a spray race for cattle were drawn up and an article on a dip tank for cattle completed. One of these spray races constructed by a farmer in collaboration with the Division is now in operation and investigations are currently in progress in which the efficiency of this unit will be analysed.

Intensive pig housing

A series of articles on intensive pig housing has been started. The first, entitled "Intensive pig housing: Ventilation and the micro-environment", was published.

Animal waste management

A start was made with a series of articles on animal waste management. The first, entitled "Animal waste management. Animal waste as a supplement to artificial fertilizers", was published.

Advice was given to the Department of Health in the drafting of a new set of proposed regulations for animal waste handling, which will form part of the new Health Act. Assistance was given to various health authorities in the solving of problems related to intensive animal housing systems which constituted a pollution hazard in terms of these proposed new regulations.

LIVESTOCK AND PASTORAL PRODUCTS IMPROVEMENT SCHEMES

NATIONAL MILK RECORDING AND PROGENY TESTING SCHEME

The number of herds subjected to performance testing during the year under review

remained constant at about 1 040, but the number of cows tested per month increased by 5 000, with the result that a record number of 646 128 samples of milk were tested. This was the first year that all five milk recording co-operatives tested *all* samples for fat, protein and lactose. In view of the fact that low lactose test results indicate abnormal milk, the year under review was clearly a period when a great deal was done to help dairy farmers participating in the Scheme with the management of their herds. In a large percentage of cases low lactose tests indicate possible subclinical mastitis. If confirmed by further examination, the condition can be treated early. Preliminary results showed that during a given month at least 23 % of the cows produced abnormal milk (as indicated by low lactose results) on the testing day. This varies, however, from region to region - 4 743 out of a sample of 19 921 cows showed low lactose. Approximately 92 % of all participants in the Scheme are now taking their own samples. This requires increased control by the Institute.

- (i) The official National Progeny Testing Scheme gained ground during the past year and test calves have already been born. The percentage of conceptions, against the number of doses of test semen issued, is still disturbingly low (between 30 % and 40 %) and preliminary results indicate that 14.6 heifer calves are born for each 100 doses of test semen.

At present 15 130 test cows are available under contract for the testing of young bulls. The table at the top of the next page shows that it is possible to test by far the highest number of bulls with the Friesian breed.

The semen of 32 bulls (21 Friesians, 5 Jerseys, 3 Ayrshires and 3 Guernseys) was distributed. At present 54 bulls are awaiting evaluation for breeding potential. Up to now 160 bulls have been approved by the advisory committee, namely 119 Friesians, 19 Jerseys, 10 Ayrshires and 12 Guernseys.

Routine analyses were carried out on 132 Friesian, 90 Jersey, 15 Ayrshire and 24 Guernsey bulls, and published. In the process 7 738 grade heifer calves were identified.

Publications

The annual report containing data for 1975/76 was completed, in addition to historical data for 1967/68, 1968/69 and 1969/70. The results of routine analyses were published for 261 bulls.

Friesian cows tested

- (a) There was an increase in the numbers of both grade cows (19 131 - 28 196 and registered cows (3 912 - 8 780) tested.
- (b) Average milk production increased from 3 669 kg to 4 176 kg for grade cows and from 4 546 kg to 4 638 kg for registered cows. However, the average butterfat percentage decreased

		Western Cape	Eastern Cape	OVS	Transvaal	Natal	Total
	herds	43	33	15	21	85	197
Friesians	cows in herds	8 567	3 431	1 251	4 545	10 878	28 672
	contract cows	2 916	1 421	791	2 990	2 775	10 893
	herds	22	13	8	9	21	73
Jerseys	cows in herds	2 050	887	598	652	1 751	5 944
	contract cows	720	380	240	340	463	2 143
	herds	2	8	9	5	2	26
Ayrshires	cows in herds	205	732	788	457	120	2 302
	contract cows	70	374	270	150	50	914
	herds	3	13	9	-	4	29
Guernseys	cows in herds	230	1 194	583	-	258	2 265
	contract cows	80	641	315	-	145	1 180
Total number of contract testing cows							15 130

from 3,60 % to 3,49 % for grade cows and from 3,73 % to 3,59 % for registered cows.

Jersey cows tested

- There was a decrease in the number of registered cows (5 318 to 4 731) and an increase in the number of grade cows (4 509 to 5 222) tested.
- Both grade and registered cows showed an increase in average milk production - grade cows from 2 851 kg to 3 155 kg and registered cows from 3 298 to 3 155 kg. The average butterfat percentage decreased in both cases - from 4,80 % to 4,56 % for grade cows and from 5,03 % to 4,81 % for registered cows.

BEEF CATTLE PERFORMANCE TESTING SCHEME

Owing to the oversupply of beef and the consequent marketing problems, the past year was a period of uncertainty for the beef producer. There was a general increase in costs while the price of beef remained virtually constant and that of breeding animals dropped sharply.

Interest in performance testing, with the object of using objective criteria in the selection and improvement of beef cattle herds, however, increased steadily. The merging on computer level of all national schemes with stud book associations has aroused much interest and the stud industry is looking for methods of involving all its members in performance testing.

As Table 1 shows, the membership increased by 21 during the past year, to reach a total of 1 160. As a result of the political conditions and increased marketing problems in South-West Africa, this region showed the greatest loss of members. The number of mass determinations decreased by 3 115, which can be attributed to the withdrawal of 24 established herds in South-West Africa.

The growth tests on young bulls were supplemented this year by tests carried out at a non-Departmental testing centre at Potgietersrus and a Departmental centre at Cedara. The four

TABLE 1 - Number of members and masses recorded, 1977/78

Region	Members 1976/77	Members 1977/78	Masses 1976/77	Masses 1977/78
Transvaal	390	407	86 183	86 837
Natal	180	200	67 700	60 320
South-West Africa	171	147	54 622	48 069
Northern Cape	148	161	36 638	44 722
Eastern Cape	138	150	30 169	33 349
Free State	95	79	14 908	14 363
Western Cape	17	16	1 946	1 391
Total	1 139	1 160	2 292 166	289 051

Departmental testing centres in the Republic and the one in South-West Africa received less support than was generally expected. This can be attributed to the increasing feed costs and the decreased demand for breeding bulls. The total number of bulls subjected to growth tests is given in Table 2.

TABLE 2 - Number of bulls subjected to growth tests, 1976/77

Centre	Bulls tested	
	1976	1977
1. <i>Departmental centres</i>		
Irene	169	266
Vryburg	158	272
Queenstown	96	133
Cedara	-	33
Omatjienne	9	35
2. <i>Non-departmental centre</i>		
Potgietersrus	-	55
3. <i>Tests carried out on farms</i>		
Republic	1 453	1 538
SWA	283	186
Total	2 168	2 518

Table 2 shows that 350 more bulls were tested during the past year than during 1976.

The first official progeny groups for carcase evaluations were accepted during 1978 and will be slaughtered for the taking of measurements and for muscle-fat-bone analyses.

PERFORMANCE TESTING OF WOOLLED SHEEP

A record number of 23 085 wool samples were analysed at the fleece testing centre during the year under review, which exceeds the previous year's record by more than 3 000. Over the past few years woolled sheep breeders have shown increasing interest in performance testing.

In addition to analytical services, the Centre also provides a specialised professional extension service for breeders. During the year under review lectures and courses were offered to 850 breeders and officers and a further 55 breeders were visited personally.

MUTTON SHEEP PERFORMANCE TESTING SCHEME

The tendency to include a fat-tailed type, namely the Van Rooy sheep, in performance testing is a possible indication that as a result of the cost structure this type of ram will be used more frequently for breeding slaughter lambs on poor grazing, with the minimum of supplementary feeding and lick supplementation.

Fourteen breeds are served at present, the SA Mutton Merino, Dorper and Dormer being the most important. The growth of 5 823 ram lambs and 6 194 ewe lambs - 12 017 in all - was measured, which is the biggest number measured so far. Interest in this scheme is increasing.

PIG IMPROVEMENT SCHEME

Pig Recording and Health Control Phase

At the end of the year there were 56 members, which is 8 more than the previous year. The 56 members of the Pig Improvement Scheme are responsible for approximately 80 % of the annual pig registrations and the scheme therefore has a tremendous influence on the pig stud industry in the Republic.

Table 1 shows the number of litters recorded, according to region and breed.

TABLE 1 - Number of litters

Region	Number of litters recorded				Total	
	SA Landrace		Large White		1976	1977
	1976	1977	1976	1977	1976	1977
Transvaal	1 411	1 310	425	413	1 836	1 723
Natal	504	608	129	154	633	762
Eastern and Western Cape	517	696	92	225	663	921
OFS	456	448	154	191	610	639
Total	2 942	3 062	800	983	3 742	4 045

The total number of litters recorded showed a relatively large increase. The increase in the number of Large White litters recorded was approximately 23 % and that in the number of SA Landrace litters approximately 4 %, but the ratio of SA Landrace to Large White litters was 4:1. The average fertility and production figures for pigs

born between 1 January 1977 and 31 December 1977 are given in Table 2.

The two figures that are of great economic importance in any pig enterprise are the average number of litters per sow per year and the number of piglets reared per sow per year. According to Table 2, the average number of litters per sow per year for the SA Landrace is 1,6. In 1974 the figure for the German Landrace (51 826 litters recorded) was 2,0.

One figure that is giving rise to much concern is the number of piglets born per sow per year (14,7 for the SA Landrace). The figure for the German Landrace is 21,5 piglets born per sow per year and 19,1 reared. The mortality is 15 % as against 11,1 % in Germany. It is therefore clear that there is much scope for improvement in our pig stud industry.

Performance testing (boars and sows)

Tables 3 and 4 show the results of tests carried out on boars and gilts at the 3 testing centres, viz Cedara, Elsenburg and Irene. A total of 1 181 boars were tested, which is 20 % more than the previous year. At Elsenburg the demand for boar testing was so high that no gilts could be accepted for testing. In fact, 48 % of the applications for the testing of boars had to be rejected as a result of a shortage of facilities. The testing facilities at Elsenburg are therefore being fully utilised.

Although Irene has double the capacity of Elsenburg or Cedara, fewer boars were tested at Irene than at Elsenburg. It should, however, be born in mind that progeny testing is centralised at Irene, where all progeny groups are accommodated. Cedara tested the lowest number of boars but by far the highest number of gilts. The average feed conversion ratio for Landrace boars at Cedara remains high in proportion to the other two centres.

Progeny testing

The test consists basically of the evaluation of five slaughter groups, selected from five litters and bred by a boar from five unrelated sows. A slaughter group consists of 2 piglets (a castrated boar and a gilt) selected at random from a litter. The growth tests start at a mass of 27 kg and when a mass of 86 kg is attained the pigs are slaughtered for further carcass evaluation. Irene received 75 such slaughter groups (150 pigs) for progeny testing.

General

The incidence of sensitivity to stress among South African pig herds is a cause for concern because pigs that are sensitive to stress tend to die very easily when exposed to any form of stress, such as that caused by ambient temperatures and even handling. Pigs that are sensitive to stress also produce meat of a poor quality, known as PSE

TABLE 2 - RSA averages

Breed	Litters recorded	IFP* (days)	365 days IFP	Per sow per year		Number of piglets per litter		
				Litter	Piglets	Born	At 21 days	% mortality
SA Landrace	3 062	182	2,0	1,6	14,7	9,5	8,1	15
Large White	983	174	2,1	1,5	15,5	10,2	8,6	16

*IFP = Inter-farrowing period

(pale, soft, exudative), which can be very harmful to the industry.

Pigs that have the genetic potential to develop stress sensitivity can be identified and eliminated immediately after weaning by means of the halothane testing method. Halothane is a volatile liquid which is used to anaesthetise animals. Stress-sensitive pigs are allergic or sensitive to halothane and react violently when exposed to it.

POULTRY PERFORMANCE TESTING

Eighth random sample egg-laying test at Irene 1977-1979

The number of breeders registered for the egg-laying test decreased during the past 2 years. This can possibly be attributed to the tremendous expansion of 2 large feeding companies that took over established poultry breeding farms. Eleven breeders participated in the test and there were 13 local and 5 foreign entries (and 2 controls). Foreign entries also decreased drastically, possibly as a result of the fact that local importers have already obtained their selected breeding material.

The results obtained with local breeding material (in the egg-laying test) compare very favourably with those obtained with breeding material from abroad. In the current test the single cage test was abandoned and in the housing density test the full entry of 192 hens per breeder was replaced by 3 hens per cage because this increased the reliability of the test.

Thirteenth random sample egg-laying test at Glen 1977-1979

Three breeders participated in the current test, with 9 entries and 2 controls. The marked

decrease in the number of entries can probably be attributed to the decrease in the number of PPLO-negative breeding farms and to the fact that the hens in this test are housed on soil, which is regarded as an obsolete method.

Random sample broiler test at Irene 1978

Six breeders participated in this test, one of whom is from abroad (Australia). The performance of the broilers was remarkably good. The foreign participant's entry was of a very high standard as regards body mass and feed conversion.

POULTRY MULTIPLICATION SCHEME

During the year under review three firms imported breeding material of laying breeds and a portion of this material was donated to the State. Some of the material has already been made available to the industry. It was possible to meet the steady demand for breeding material at all times.

ANIMAL HEALTH

VETERINARY RESEARCH INSTITUTE

Fewer crises caused by unexpected disease problems had to be dealt with by the Institute this year than in previous years, with the result that it was possible to devote more attention to the normal functions of research and the associated diagnostic work.

A variety of research projects relating to ticks and tick-borne diseases are currently receiving

TABLE 3 - Boar performance testing

Breed	Number	Age in days	ADG (range)	Average performance	
				FCR (range)	C + K (range)
SA Landrace	897	143	0,86 (0,64-1,14)	2,93 (2,29-4,42)	36 (18-56)
Large White	284	138	0,92 (0,71-1,20)	2,74 (2,25-3,79)	36 (17-62)

TABLE 4 - Sow performance testing

Breed	Number	Age in days	ADG (range)	Average performance	
				FCR (range)	C + K (range)
SA Landrace	169	153	0,77 (0,62-0,97)	3,37 (2,58-4,90)	42 (29-56)
Large White	46	145	0,84 (0,67-1,00)	3,10 (2,56-3,74)	43 (34-57)

ADG : Average daily gain
FCR : Feed conversion ratio
C + K : Ultrasonic fat measure

attention. Resistance to chemical pesticides in ticks is being carefully watched. It is clear that resistance of blue ticks to the older dipping fluids is no longer uncommon, but good advice on control with the aid of pesticides is being offered on the strength of tests carried out on ticks from farms which have a resistance problem.

Studies on the epidemiology of redwater are making good progress and the information yielded by these studies is of great value when recommendations are made on the control of the disease. Two new tick vectors of gallsickness have been discovered, namely the red-legged tick and bont tick. The importance of these widespread tick species in the epidemiology of gallsickness has now to be assessed.

Studies on heartwater have shown that inoculated animals remain immune for a considerably longer period than was previously supposed. This finding is of material importance for the interpretation of the epidemiology and the implementation of scientific control measures against the disease. Good progress has been made, in conjunction with the Division of Veterinary Services, with the research programme on the transmission of swine fever by tampons.

Further research on *Parafilaria* infestation (false bruising) has demonstrated that cattle may become infested when infected flies (*Musca lusoria* or *M. xanthomelas*) feed on skin sores. A detailed analysis of the economic importance of the disease has revealed that the highest percentage of infestation occurs in the Northern Transvaal, where approximately 40% of all cattle slaughtered are affected.

The world reference centre for bluetongue at Onderstepoort identified bluetongue virus in a specimen of midge origin received from Australia. This is the first time that bluetongue has been confirmed in Australia.

Good progress is still being made with research on jaagsiekte, success having been achieved when the disease was transmitted with subcellular fractions from lung tumour material. This suggests an infective component additional to the herpes virus which was isolated earlier but with which it was not possible to induce the disease.

During the year under review a virus which had been isolated on only one previous occasion - in 1974 - was isolated from several horses suffering from hepatitis in the Johannesburg-Pretoria district.

Serological tests have indicated that the hitherto relatively unknown contagious bursal disease (Gumboro disease) is apparently widespread in South Africa on broiler and laying farms.

Laboratory investigations have shown that poisoning with pesticides containing chlorinated hydrocarbons has taken a higher toll than even urea, which is still a very important cause of poisoning in cattle.

By 1 July 1977 the Institute had registered a total of 186 research projects. A further 6 were undertaken this year and 22 were finalised. A total

of 50 scientific articles were published during the year.

The demand for vaccines reverted to the highest figure reached in 1975/76, namely 170,9 million doses. While the demand for vaccines against Rift Valley fever, Wesselsbron disease and Newcastle disease showed a steady decline, the use of bluetongue and infectious bronchitis vaccine increased considerably. The Institute achieved an important objective when a combined quarter evil/lamsiekte vaccine was released for distribution. The vaccine against three-day stiffness was withdrawn on account of adverse reports on its efficacy.

VETERINARY RESEARCH

BACTERIAL DISEASES

Actinobacillus seminis infections in rams

A. seminis is recognised as an important cause of sterility in rams and hitherto it has not been possible to control the disease. A trial vaccine, developed here and tested in guinea-pigs, produced a high antibody titre and a perceptible cellular reaction. However, it was not possible to reproduce the disease experimentally with *A. seminis*, and consequently it could not be established whether inoculated guinea-pigs and sheep were immune to challenge.

Anthrax

A culture medium was discovered in which *Bacillus anthracis* proliferated to such an extent that there was a development of more than 1×10^{11} spores per ml. The glycerol, glycerophosphate and NaCl constituents of the culture medium were chiefly responsible for the high concentration of spores. Although all the tests have not yet been completed, it should be possible in future to propagate the organisms for vaccine production on a large scale in 10 litre fermentors instead of the small volumes possible until now.

Bovine pleuropneumonia

Researchers have succeeded in preparing bovine pleuropneumonia vaccine in freeze-dried form. Previously the vaccine was used in liquid form and had a limited shelf life, whereas the freeze-dried vaccine remains viable for 3 months at 4°C. Higher temperatures have an adverse effect on its viability. In addition it has been found that 1% peptone in phosphate buffer is the most effective diluent.

Mastitis

A trial vaccine against *Staphylococcus aureus*, one of the most important causes of mastitis, has been developed and tested in rabbits. A vaccine containing 2 *S. aureus* strains provided rabbits with protection for 4 months against a highly toxigenic strain of *S. aureus*, and for 6 months against a

purulent strain of the organism. The vaccine is currently being tested in the field in milk herds with mastitis problems.

Diagnostic work

Again, there has been a decrease in the number of specimens from calves submitted for examination for colibacillosis, but the number of pig specimens remains high. The apparent reason for this is that the vaccine, which is effective against colibacillosis in new-born pigs, is less effective in weaners, especially since pigs these days are often weaned early.

PROTOZOAL DISEASES

Redwater

Good progress has been made with studies on the epidemiology of redwater in cattle. In the North-Western Cape, where climatic factors, especially rainfall, are normally unfavourable for blue ticks (*B. decoloratus*), but have been more favourable in recent years, a direct correlation was established between the incidence of *B. decoloratus* and infestation with *Babesia bigemina*. Infection in 2 to 3-month-old calves varied from 0-100%. It would appear that a vigorous dipping programme in this part of the province, which is marginal for redwater, might completely exterminate the blue tick, and with it redwater, on individual farms, provided that the herds were kept closed. Animals born and bred on such "clean" farms will naturally be particularly susceptible to redwater and should not be transferred to infected farms.

A very similar situation regarding *B. bovis* infection obtains on 7 farms in the Eastern Transvaal Highveld, except that a stable enzootic situation has seldom been encountered there, even when tick control was minimal. It is therefore clear that inoculation against *B. bovis* is essential if a vigorous dipping programme aimed at bringing the disease completely under control is not followed.

Gallsickness

Good progress has been made with a new project on the transmission of gallsickness. A new vector in the form of the bont-legged tick, *Hyalomma marginatum rufipes*, has been found. Transmission has been effected with adult ticks removed from cattle in the Barkly West district and fed on a susceptible splenectomised animal. *Anaplasma marginale* could be demonstrated in blood smears 17 days after infection and the parasitaemia reached 64% on the 24th day, after which the animal was treated.

Likewise it was established that the red-legged tick, *R. evertsi*, can transmit gallsickness. The prepatent periods and level of parasitaemia showed a close parallel with the above-mentioned case. The importance of these two widespread tick species in the epidemiology of gallsickness must now be assessed.

Theileriosis

It has recently been established that, besides the known relatively apathogenic *Theileria* sp. which is transmitted by brown-ear ticks have, however, been unsuccessful. The questions now arise which of the two parasites is *T. mutans*, whether one or both can cause cerebral theileriosis, and which one is connected with the Tzaneen disease syndrome.

Dourine

Of the 2 725 specimens from the Republic of South Africa tested for dourine last year, 57 (2.6%) were positive. The distribution of these cases was as follows: Transvaal 9, Cape 39 and OFS 9. Positive specimens were also received from Bophuthatswana, Botswana, Lesotho, Rhodesia, South-West Africa and Transkei.

VIRUS DISEASES

Rabies

Research

Good results have been achieved with a high egg-passage trial rabies vaccine propagated in tissue culture. High virus titres are now being obtained in tissue culture and, although only 11% of the virus content remained intact after exposure at 37 °C for 7 days with the best stabilisers obtainable, good immunity was induced in guinea-pigs, cattle and dogs in preliminary trials. Research is still proceeding.

Diagnostic work

Of the 937 specimens submitted for investigation this year, 241 (26%) were positive for rabies. The Republic accounted for 176 of these cases, and South-West Africa for 65. The number of cases of the disease is given under the various host species:

Cattle	62
Dogs	52
Domestic cats	9
Other farm animals	8
Yellow mongooses	45
Genets	4
Other mongooses and ground squirrels	11
Wild cat species	13
Black-backed jackals	8
Bat-eared foxes	6
Other predators	6
Wild ruminants	14
Hares	1
Humans	2

Four specimens were received from foreign countries, of which 2 from Botswana were positive.

Compared with the position in the RSA last year, the rabies situation has remained reasonably steady. In South-West Africa, however, there was a notable change in the species of animals involved. Dogs and jackals accounted for 40% of positive cases as against 30% in the previous year.

The total of wild ruminants (especially kudus) with rabies increased from 4,5 % to 31 %.

An analysis of all the confirmed cases of rabies over the past 10 years shows that to the three traditional rabies areas, a fourth can now be added. In the northern parts of the Transvaal and South West Africa, dogs and jackals are the most important vectors of the disease, as is the yellow mongoose in the central areas of the country. In the fourth area, which includes the southern parts of SWA, the Gordonia, Kenhardt, Kuruman, Postmasburg districts and parts of Calvinia and Vryburg, domestic cats, wild cats and genets are the chief vectors, while rabies is rarely encountered in farm animals.

Swine fever

Progress has been made with research, undertaken in collaboration with the Division of Veterinary Services, on the epidemiology of African swine fever. Observations in the Thabazimbi district (Makoppa area) have shown that the vector *Ornithodoros moubata* occur only in warthog holes in clayey soil and not in red sandy soil. These holes have to be dug out and the soil sifted for *tampans*, since it is not possible to attract them with compounds such as CO₂. Approximately 500 *tampans* were collected and are currently being examined for infection with swine fever virus.

Serological investigations on a variety of animal species have produced positive results only in warthogs. All 3 warthogs from the Makoppa area were positive, but 7 from the Mkuzi Game Reserve, Zululand, were negative.

Bluetongue

A virus isolate derived from *Culicoides* in Australia was identified as bluetongue by means of complement fixation tests. Despite a degree of crossing with Types 4 and 7, this isolate is regarded as a new serotype (Type 20). The strain was partly attenuated with egg-passages to promote the development of a vaccine.

Type 4 bluetongue virus was identified from blood specimens of sheep from Turkey, and antibodies against Types 1 and 4 in sheep and Types 1, 2, 4, 13, 17 and 20 in cattle were confirmed in sera sent from Brazil.

Despite outbreaks of bluetongue on a large scale in various parts of the country, few specimens from sheep were received for serotyping this year. Type 19, which was prevalent in the Southern Orange Free State and Northern Cape in 1976, was isolated from *Culicoides* at Onderstepoort and from sheep at Middelburg, Transvaal.

Temperature-sensitive mutants of bluetongue virus were experimentally isolated and these are at present being tested for their immunising properties.

Horsesickness

The isolation of safe, highly immunogenic, large plaque clones for Types 5 and 7 horsesickness virus has resulted in further progress with the development of an improved vaccine against the disease. Suitable combinations of the envisaged bivalent vaccines will be tested for their efficacy.

Ephemeral fever

Ephemeral fever (or three-day stiffness) occurred as an epidemic in the Western Province and the virus was isolated and identified on more than one occasion from the cases examined.

Virus diarrhoea in calves

It was established that rota virus, corona virus and corona-type virus particles were present in most of the faeces specimens of scouring calves submitted from various places throughout the country.

Viruses from midges and mosquitoes

Twenty-three virus isolates were made from 38 groups of *Culicoides* caught in light traps at Onderstepoort. Bluetongue (Types 3, 5 and 19), horsesickness (Type 4), Palyam and Akabane viruses have already been identified. Seven virus isolates were made from 33 groups of mosquitoes, but the viruses have not yet been identified. Akabane virus has also been identified from lambs which died one week after birth.

A virus was isolated from several cases of hepatitis which occurred during April 1978 in horses in the Johannesburg-Pretoria district. Attempts at identification indicated that the virus was identical with the hepatitis virus which was isolated in 1974 from a case of terminal hepatitis and that these viruses fall under the encephalosis subgroup of the insect-borne orbiviruses. The related Bryanston virus was also isolated from some horses with apparent hepatitis. The viruses, both of which cause a drastic reduction in red and white cells, thus occurred simultaneously in the area.

Wesselsbron disease

None of the 18 ewes which were infected with a virulent Wesselsbron disease virus when 50-72 days pregnant aborted, but since one did not lamb, it presumably resorbed the foetus. Thirteen ewes gave birth to normal lambs but four of the ewes produced lambs with teratological abnormalities of the brain. Two of the lambs showed atrophy of the cerebral hemisphere and mild hydroencephalus; the other two had pronounced hydranencephaly and arthrogryposis. Wesselsbron disease virus has occasionally also been found to be teratogenic for the developing brain of the bovine foetus.

None of the 39 adult sheep or of the 15 adult Boer goats inoculated with Wesselsbron disease virus showed any symptoms of the disease apart

from febrile reactions. It may be deduced from this that Wesselsbron disease is a very mild disease in adult sheep and goats. New-born lambs and kids, however, are fairly susceptible to the disease, as was indicated in last year's report. The clinical symptoms are not characteristic of the disease, but jaundice is often encountered and the typical lesions in the liver are usually pronounced.

Jaagsiekte

All attempts at experimentally inducing jaagsiekte in sheep with *Herpesvirus ovis*, *Mycoplasma ovipneumonia* or a combination of the two organisms have so far proved unsuccessful. Both organisms have been isolated from the lungs of natural cases of jaagsiekte but they do not occur in every case. Since no antibodies against *Herpesvirus ovis* were found in 100 sera obtained from sheep in Iceland, the only country in the world with a proven jaagsiekte-free sheep population, the possibility that the virus may be the cause of jaagsiekte cannot yet be ruled out.

Further success has been achieved with transmitting jaagsiekte by means of subcellular fractions (a cytoplasmic extract) prepared from lung material affected by the disease. This, together with the absence of isolable viruses other than herpes virus, suggests the presence of an infective component such as a type C RNA virus or a leukosis type virus. This is a subject for further research.

POULTRY DISEASES

Newcastle disease

The value as booster vaccines of two inactivated oil-based trial vaccines against Newcastle disease was compared with that of an oil-based imported vaccine and the Onderstepoort standard living (Komarov) vaccine in young fowls after primary inoculation with the Komarov vaccine at 9 weeks of age. The trial vaccines induced a better antibody response than either the imported or the Komarov vaccine. The antibody titres in the trial vaccines were high enough to prevent both falls in egg production and mortalities, whereas the titres of existing vaccines provide protection only against mortalities.

The Komarov vaccine strain of Newcastle disease has been successfully propagated in tissue cultures obtained from chicken embryos. The immunogenicity of the tissue culture vaccine is at present being assessed with the ultimate objective of replacing the present egg vaccine with a tissue culture vaccine.

Infectious bursal disease (Gumboro disease)

A limited serological survey, undertaken on 9 farms with the aid of an agar-gel precipitation test, showed that this viral disease, confirmed recently for the first time in South Africa, is apparently widespread in this country. All the farms (both broiler and laying farms) were positive for the

presence of Gumboro disease, but not all flocks were necessarily infected.

Diagnostic work

Progress has been made with an investigation into the cause of the high mortality rate in adult turkeys experienced by the biggest turkey producer in the country. A virus, which may be responsible for the disease, has recently been isolated. Further studies to confirm whether the virus, which is possibly transmitted by insects, is implicated in the disease are currently being undertaken.

INFERTILITY AND VENEREAL DISEASES

Chlamydiosis

There has been a steady decrease in the incidence of the disease, from 17 % in the foetuses of sheep last year to 8,3 % this year, the corresponding percentages in cattle being 11 % and 7,6 % respectively. The possible role of *Chlamydia*, mycoplasmas and viruses in the aetiology of the "epivag" syndrome in cattle is being investigated by a team of research workers.

Brucellosis

Much attention is still being given to the isolation and identification of *Brucella* strains from bovine foetuses and other material submitted from farms where abortions occur. *Brucella abortus* was confirmed this year on 21 % of these farms. The considerable increase in the percentage may be attributable to the greater number of placentae submitted with the foetuses for examination. Of the 21 200 cattle sera examined for brucellosis, 10,5 % were positive, in comparison with 11 % in 1976/77.

Vibriosis and trichomoniasis

Campylobacter fetus intestinalis was isolated this year from 9 bovine foetuses; no ovine foetuses proved positive for vibriosis.

The sheath washings of 1 767 bulls were examined; 2 % were positive for vibriosis this year as against 3 % in 1976/77 and 5 % in 1975/76. The corresponding figures for trichomoniasis were 3 %, 6,2 % and 4,7 % respectively.

POISONING

Photosensitivity

A highly toxic, sporidesmin-producing, photosensitivity-inducing strain of the fungus *Pithomyces chartarum*, was isolated a few years ago from dubbeltjies collected near Aberdeen in the Karoo during an outbreak of geeldikkop. Tests are now being carried out in conjunction with the Division of Veterinary Services and other departmental bodies at Middelburg, Cape, to determine the relationship between the facial eczema-like condition induced at Onderstepoort

with sporidesmin from the above-mentioned strain of *P. chartarum* and geeldikkop.

Diagnostic work

Pesticides containing chlorinated hydrocarbons were responsible for most cases of poisoning in ruminants this year. The surprising thing is that, although dieldrin is banned, it was responsible for approximately 50 % of the mortalities.

Because urea is often used injudiciously in rations and licks, it is still an extremely important cause of poisoning in ruminants. Arsenic also still causes many unnecessary deaths.

Poisoning with pesticides containing organophosphorus tended to decrease this year, but this will probably only be temporary.

Lead poisoning in cattle, and especially in calves, is still quite common and is caused by cattle chewing motor batteries. Salt poisoning likewise took its usual toll of cattle, pigs and poultry.

Strychnine was the poison most commonly used in the malicious poisoning of dogs, but dieldrin and endosulfan (a pesticide containing chlorinated hydrocarbons) were also misused for this purpose.

INTERNAL PARASITES

Parafilariasis in cattle

Further research on the life cycle or the parasite demonstrated that cattle become infested through skin wounds when these are fed upon by infested *Musca lusoria* or *M. xanthomelas*. Cattle may also be infested via the ocular mucous membrane or by subcutaneous and intravenous administration of the parasite. It takes 167 to 250 days for the worms to reach the adult stage, and from 242 to 319 days post-infestation before the bleeding points appear in the skin. There is clear evidence from the sites of these lesions that worms migrate.

A comprehensive analysis of the economic importance of parafilariasis is now nearing completion. A total of 32 042 animals have been examined in three different abattoirs, and from this investigation it has emerged that 35,9 % of the animals in the Northern Transvaal, 13,5 % in the Cape, 12,2 % in the South-Western Transvaal, 6,2 % in Natal, 1,9 % in the Western Free State, 1,8 % in the Eastern Free State and 0,7 % in South-West Africa are affected with parafilariasis. The highest incidence occurred in the Northern Transvaal, where the sourish, mixed bushveld (47 %), mixed bushveld (41,3 %), sour bushveld (40,9 %), thorn veld (32,5 %) and arid sweet bushveld (31,5 %) registered the highest percentages. The disease was less prevalent in the mopani veld (11,3 %) and the Pietersburg plateau (14,3 %) and even less so in the banken veld (2,5 %) and true grassveld regions (2 %).

Optimum conditions for the occurrence of the disease are a rainfall of 400 - 700 mm, a frost

period of < 90 days, a mean annual temperature of 17,5 - 22,5 °C and an altitude above sea level of 800 - 1 200 m. In the bushveld areas there was a significant increase in the incidence of the disease in animals over the age of 2 years, and a decrease in animals over the age of 4 years.

RUMINANT DIGESTION

Urea supplementation

Research on sheep fed a diet of poor teff hay supplemented with 3 % urea and 6 % starch has shown that the rumen microflora never stabilise. Originally *Ruminococcus albus*, the most effective fibre digester, was predominant for 3 months, after which the organisms declined in numbers, to be superseded by *Butyrivibrio fibrosolvens*, a much less effective fibrolitic organism. This indicates that the recommended use of licks containing urea for periods lasting up to 6 months is questionable.

EXTERNAL PARASITES

Resistance of ticks to dips

The survey on the occurrence of resistance to chemical pesticides in ticks is proceeding. A few dioxathion-resistant strains of the brown-ear tick (*R. appendiculatus*) and the red-legged tick (*R. evertsi*) have been discovered by means of larval tests. In the case of the blue tick, a high level of resistance to dioxathion is a fairly general phenomenon, but populations of blue ticks with a low resistance have also been found. These may undergo selection for resistance if dips are used under strength. Blue ticks even tend to be highly resistant to chlorfenvinphos. The only pesticides to which blue ticks do not appear to be highly resistant are the two more recently developed formamidine preparations.

Routine tests on field specimens of dipping compounds have shown that only 28 % were used at the recommended strength; 51 % were under strength and 21 % were over.

Biological control of ticks

Continued research on red-billed oxpeckers has shown that the dipping compounds chlorfenvinphos, quinthiophos, camphechlor, arsenic trioxide and a combination of chlorfenvinphos and dioxathion are toxic to these birds. All birds feeding on ticks which had been dipped or had been in contact with the pesticides succumbed to the poison. On the other hand, chloromethiuron, amitraz and DDT apparently had no toxic effect over an observation period of 50 days.

Black flies (*Simulium* spp.)

Attempts at controlling midges in the Vaal River by water manipulation were continued and extended to the Orange River. The latter river was shut off at the P.K. le Roux Dam for 67 hours at weekends. Extremely satisfactory control was

effected between the dam wall and Douglas, but the sections of the river beyond Prieska and Koegas have still to be evaluated.

Sweating sickness

On the strength of specific circumstantial evidence, sweating sickness has hitherto been regarded as a tick toxicosis of the bont-legged tick, *Hyalomma truncatum*. Modern techniques have made it possible to collect relatively large quantities of saliva from *H. truncatum* but, despite this technological breakthrough, it has not been possible to induce sweating sickness by administering this saliva. Even trials with tick suspensions have not yielded positive results. Since this suggests that the disease is not caused by toxins in the saliva of the ticks, research to determine the cause of sweating sickness is still being pursued.

Heartwater

Continued research on the proliferation of the causal organism, *Cowdria ruminantium*, in the bont tick indicates that in adult females, as in nymphae, the organism increases tremendously as soon as the ticks begin to feed. Sheep could regularly be infected with heartwater by intravenous injection with 1/200 dilutions of a single tick for a period of 28 days after the ticks had fed to repletion. The possibility of using infected nymphae for the production of a heartwater vaccine looks promising. Adults may be too toxic.

Good progress is being made with the experiment to determine the duration of immunity in cattle after inoculation with heartwater blood. It was confirmed that cattle were still immune 3, 6 and 12 months after inoculation. Eleven out of 15 controls showed febrile reactions and 7 of these animals had to be treated with tetracyclines. The last group of animals will be challenged 24 months after immunisation. A correlation has been observed between the presence of inhibitors in the serum of animals which had not previously been exposed to heartwater and their resistance to infection with the disease by administration of heartwater blood.

TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

During the year six scientists or officers from the African states of Botswana, Malawi, Rhodesia and Transkei, and the Island of Réunion, visited the Institute.

The following neighbouring countries purchased Onderstepoort vaccines through the official channels. Onderstepoort vaccines sold to neighbouring countries by private firms are not included in these figures.

	No. of doses
Botswana	469 687
Lesotho	1 746
Malawi	42 245
Mauritius	400
Rhodesia	2 330 498
South-West Africa	4 938 692
Swaziland	210 223
Zambia	2 635 750
Total	10 629 241

The Institute also received 2 477 specimens (for diagnosis) from Botswana (137), Lesotho (211), Rhodesia (1 151), Swaziland (139), South-West Africa (828), Zaire (4) and Malawi (7).

Liaison with overseas countries

Twenty-nine overseas scientists paid short visits to the Institute during the year. In addition, 51 foreign tourists visited the Institute in groups of varying sizes.

Vaccines

Onderstepoort vaccines were sold to -

	No. of doses
Hong Kong	100
Bahrain	45
Israel	205 000
Total	205 145

Total sales of vaccine to foreign countries

Approximately 6,3 % of the Onderstepoort vaccines were sold through official channels to other countries, the majority of which are neighbouring states. This percentage is an underestimate, however, since accredited wholesalers are now selling Onderstepoort vaccines to neighbouring states in fairly large quantities.

Technical assistance and advice

World Reference Centre (OIE) for Bluetongue and Horseshoe

Bluetongue

A virus isolated from midges (*Culicoides*) in Australia was received for identification and typing. The virus was identified as bluetongue virus and despite a limited measure of crossing with serotypes 4 and 17, was regarded as a new serotype, Type 20. Serum specimens received from Australia also pointed to the presence of the Type 1 bluetongue virus in that country. So far, serological indications of infection with bluetongue have been found only in water buffaloes and cattle. This is the first time that bluetongue has been confirmed in Australia and it would seem to have serious implications for that country, which is a major wool producer.

Type 4 bluetongue virus was isolated from ovine blood specimens received from Turkey. Sera were also positive for Type 4.

Antibodies against Type 1 and 4 in ovine sera and Types 1, 2, 4, 13 and 20 in bovine sera were identified in specimens submitted from Brazil.

Overseas study tours

Two officers undertook short study tours during the year, and two others paid overseas visits lasting a year in connection with the envisaged research on and other activities connected with foot-and-mouth disease.

VACCINES AND STOCK REMEDIES

VACCINE PRODUCTION

In many respects the past year was relatively uneventful. As there was no exceptional outbreak of any particular disease and no severe crises, the production unit was able to stabilise its production programme and pay more attention to development.

During 1976/77 production dropped from 170,9 million doses in 1975/76 to 159,2, but, possibly because of the improvement in the economic situation, the total issues for 1977/78 reached 170,8 million doses, which represents an income of R1,9 million.

The same trend was observed in the issues of diagnostic antigens, which rose from 194 litres in 1976/77 to 223,9 litres in 1977/78. The most pronounced increase was in the issues of *Brucella abortus* Rose Bengal antigen, which rose from 1,9 litres to 7,0 litres. This increase is due to the present intensified campaign for the eradication of brucellosis.

Bacterial vaccines

Issues of fowl typhoid vaccine followed the previous year's steady decline but the demand for coryza vaccine increased dramatically, namely, from 1,7 million doses to 3,9 million doses in 1977/78. Issues of *Pasteurella* vaccine increased from 1,9 to 2,3 million doses.

A significant advance was made in respect of the lungsickness vaccine. It is now issued as a freeze-dried product, which appreciably improves its keeping quality and facilitates administration.

Another outstanding achievement was the release of a combined quarter evil/botulism vaccine. Initially there was little demand for this product but as farmers came to realise its advantages the demand gradually increased.

The Institute has also made a botulism antiserum available as an ethical product for use by registered veterinarians only.

Owing to an unsatisfactory production technique, the Institute was again unable to keep abreast of the demand for *Vibrio fetus* vaccine. Some progress has been made with respect to the cultivation of the organisms in a fermentor tank,

however, and, if this procedure succeeds, it will be possible to meet the requirements.

The mastery of the production technique for coryza vaccine has enabled the Institute to more than double its production of this vaccine.

Virus vaccines

The issues of infectious bronchitis vaccine increased from 2,4 million doses last year to 5,2 million in 1977/78.

Conversely, the demand for Rift Valley fever vaccine (inactivated and live) and Wesselsbron disease vaccine dropped from 5,0 million and 3,3 million to 3,0 million and 1,6 million doses respectively. This is a reflection of the decline in the incidence of these diseases.

Field reports following the use of the three-day stiffness vaccine indicated that the protection afforded by the vaccine during the present severe outbreaks of the natural disease did not come up to expectations in all cases. In view of these unfavourable reports it has been decided to stop any further issues of the vaccine until the reasons for the apparent failure of protection have been elucidated.

The keeping quality of the inactivated Rift Valley fever and Wesselsbron disease vaccines and the potency of the *Chlamydia* vaccine are also currently receiving attention.

Protozoal and Rickettsial vaccines

There was a slight decrease in the issues of all protozoal vaccines but a continued steady increase in demand for heartwater blood. Thanks to improved production and storage techniques, it was possible to reduce the dosage of heartwater blood from 10 ml to 5 ml, and also to reduce the price per dose.

DIVISION OF VETERINARY SERVICES

Three outbreaks of foot-and-mouth disease were mentioned in the previous report. There have since been three further outbreaks in the proclaimed control area adjacent to the Kruger National Park, viz. in the Giyani and Mhala (Gazankulu) and Bolobedu (Lebowa) districts. The SAT II strain of the virus was responsible for these outbreaks as well. Officers from this Division went to these areas to help deal with the outbreaks. The necessary control measures, which included both the re-inoculation of susceptible animals on affected farms and in threatened areas and intensified control over the movements of cloven-hoofed animals and their products, were applied in every case. The administration of vaccine failed to produce the desired results, however, so that the campaign was hampered and prolonged.

VACCINE SALES

Vaccine	Doses issued		
	1975/76	1976/77	1977/78
Bacterial vaccines			
Enterotoxaemia (oil) (<i>Cl. perfringens</i> D)	17 043 850	9 786 200	11 741 100
Enterotoxaemia (alum)	23 380 000	30 430 610	30 021 800
Enterotoxaemia (total)	40 423 850	40 216 810	41 762 900
Lamb dysentery (<i>Cl. perfringens</i> B)	310 650	270 400	280 500
<i>Brucella</i> S19 (cattle)	2 720 796	2 327 598	2 717 672
<i>Brucella</i> Rev 1 (sheep)	490 250	721 560	521 780
<i>Corynebacterium ovis</i>	144 300	132 340	138 060
<i>Corynebacterium pyogenes</i>	363 100	424 760	492 900
Swelled head in rams (<i>Cl. novyi</i>)	66 850	186 700	143 800
Colibacillosis (cattle and sheep) (<i>E. coli</i>)	72 750	80 710	80 860
Colibacillosis (pigs) (<i>E. coli</i>)	182 400	258 720	260 220
Fowl typhoid (<i>S. gallinarum</i>)	4 198 500	3 524 000	2 862 800
Botulism (<i>Cl. botulinum</i> C & D)	5 016 505	5 464 230	5 234 910
<i>Clostridium septicum</i>	-	185 580	118 100
Bovine pleuropneumonia (CBPP) (<i>M. mycoides</i>)	242 160	862 800	1 105 000
Anthrax (<i>B. anthracis</i>)	13 402 307	17 077 460	18 286 430
Paratyphoid (live) (<i>S. dublin</i>)	334 302	329 186	347 006
Paratyphoid (inactivated): tri-valent	28 020	27 394	18 964
<i>Pasteurella</i> (sheep & cattle)	1 518 660	1 933 840	2 277 120
Black-quarter (quarter-evil) (<i>Cl. chauvoei</i>)	10 243 118	10 291 482	10 101 794
Tetanus (<i>Cl. tetani</i>)	128 330	182 260	161 230
<i>Vibrio fetus</i>	141 900	242 700	146 150
<i>Haemophilus coryza</i> (<i>H. gallinarum</i>)	1 230 800	1 726 500	3 929 100
Combined Black-quarter/Botulism	-	-	624 106
Total for bacterial vaccines	81 259 548	86 467 030	91 611 402
Virus vaccines			
Enzootic abortion (<i>Chlamydia</i>)	2 956 200	4 317 700	3 010 400
Bluetongue	26 167 620	20 792 152*	26 938 800*
Pigeon pox	525 180	632 600	568 300
Fowl pox	2 816 100	3 359 900	4 242 600
Distemper	36 673	34 683	36 894
Rabies LEP (dogs)	323 211	291 704	253 827
Rabies HEP (cattle & cats)	64 004	55 369	27 359
Infectious bronchitis (poultry)	2 652 000	2 440 000	5 242 600
Infectious laryngotracheitis	4 999 000	7 068 000	11 762 000
Lumpy skin disease	1 072 899	2 512 023	2 305 005
Newcastle disease (Komarov)	25 559 260	21 448 500	18 122 300
Horsesickness	182 299	185 834	173 585
IBR (Infectious bovine rhinotracheitis) (live)	62 450	132 230	134 050
Rift Valley fever (live) (sheep)	9 210 450	4 173 260	1 999 300
Rift Valley fever (inactivated) (cattle)	3 776 765	810 250	1 062 050
Wesselsbron disease	7 816 450	3 287 500	1 621 900
Ephemeral fever (three-day stiffness)	224 465	193 490	351 575
Total for virus vaccines	88 445 026	71 735 195	78 254 945
Protozoal and Rickettsial vaccines			
Anaplasmosis (gallsickness)	890 413	708 556	643 660
Heartwater blood	101 019	107 350	118 548
Redwater	117 583	108 890	104 185
Elephant skin disease (besnoitiosis)	107 710	109 410	104 110
Total for protozoal and rickettsial vaccines	1 216 725	1 034 206	970 503
Grand total for all vaccines	170 921 299	159 236 431	170 836 850
Diagnostic aids (antigens) (in millilitres)			
BWD antigen (<i>Salmonella gallinarum/pullorum</i>)	48 390	31 640	33 060
<i>Brucella abortus</i> antigen (SAT)	27 090	28 600	31 700
<i>Brucella</i> milk ring test antigen	1 353	1 338	1 540
<i>Brucella</i> Rose Bengal antigen	-	1 900	7 060
Mallein	-	9	-
Tuberculin (bovine)	840 770	97 698	108 358
Tuberculin (avian)	249 740	26 306	37 020
<i>Mycoplasma gallisepticum</i> (CRD) antigen	103 800	4 602	4 410
Total for diagnostic antigens	1 271 143	194 011**	223 911**

*Includes supplementary bluetongue vaccine

**Expressed as ml from 1976/77

The cause of this failure, which is contrary to past experience, is being investigated.

All infection has been wiped out and at the end of the year under review there were no active cases of foot-and-mouth among stock.

There was another increase in the number of cases of *rabies* in Natal; the number of cases among domestic cats was especially disquieting.

Fewer problems with *corridor disease* were experienced this year than in the previous year, one outbreak only having been reported.

For the first time since the scheme for the eradication of *bovine tuberculosis* was introduced in 1969, more than a million tuberculin tests were carried out; to be specific, the figure was 1 000 160. The 88 trained members of the stock inspectorate staff made valuable contributions to this effort. Since the diagnostic herd testing scheme was started on 28 October 1977 officers of the Division have tested 537 herds, comprising 55 612 animals. The number of tuberculosis-free certificates issued to tuberculosis-free herds in accordance with the accreditation scheme, namely 3 843, is 39,5 per cent more than last year.

A total of 700 herds (61 306 animals) have already been integrated into the voluntary accreditation scheme for brucellosis, which was introduced on 12 November 1976. The first brucellosis-free certificate was accordingly issued to a herd during the year under review. A diagnostic scheme was introduced on 1 July 1977, and tests on 2 087 herds, comprising 110 554 animals, have been carried out so far.

Outbreaks of *lumpy skin disease* increased tremendously during the year under review, especially in the Transvaal and Natal Regions.

The incidence of *sheep scab* increased. There were 321 outbreaks in 82 magisterial districts, many of which had become infected with this disease for the first time in years. In the course of the campaign to control the disease 1 130 360 head of small stock, 154 501 of them in Black states, were dipped under official supervision on infected and contract farms. A country-wide, organised dipping programme will have to be started if the disease is to be controlled. Negotiations with Organised Agricultural and other interested bodies are already under way, in view of the fact that the sheep farmer will have to assume the greatest responsibility in this regard.

A single outbreak of *African swine fever* occurred during the year. This was effectively and speedily dealt with and prevented from spreading.

There was an increase in the number of cases of *Johne's disease*. Six cases (three in the Highveld Region and three in the Natal Region) were confirmed among imported stock and/or the progeny of imported stock. The infected animals were slaughtered (one died of the disease) and the relevant farms are being kept under close observation for any possible further complications.

Twenty-two outbreaks of *bovine malignant catarrh* ("snotsiekte") occurred during the year under review; 43 animals succumbed in comparison with six in the previous year. In all but two cases there had been contact with blue wildebeest.

Pulmonary adenomatosis ("jaagsiekte") is increasing among sheep; 14 cases were reported. The first case of "jaagsiekte" from the Lydenburg State veterinary area was reported.

The regional veterinary laboratory at Stellenbosch succeeded in proving that the fungus *Stachybotrus atra* (isolated from mouldy sheep pellets) was responsible for poisoning in sheep. It is the first time that this fungus has caused poisoning in the Republic.

The *laboratory services* rendered by the Division were expanded during the year under review; the number of tests or investigations carried out was 31,2 per cent higher than the previous year. A new veterinary laboratory - at Potchefstroom - became operative during the year.

Three officers from the Division of Veterinary Services were seconded to Bophuthatswana after independence to assist with the expansion of the veterinary service in that country.

VETERINARY RESEARCH

Miscellaneous research projects

Officers of the Division of Veterinary Services continued with research work on various projects.

The A I and Reproduction Section of the Division was jointly responsible for an experiment concerning reproduction in certain Africander pedigree herds; a total of 1 657 rectal examinations were carried out on cows in the course of 8 herd investigations during this period. This Section is also engaged in a multi-disciplinary investigation into the causes of poor financial returns from fresh milk production. The reproduction problems of the 19 herds participating in the investigation are the responsibility of the Section, and 17 of these herds were visited once or twice or even more frequently during the year in this regard.

The Section of Poultry Diagnostic and Extension Services devoted considerable attention to a condition which affects mainly broilers, and is at present known as "dikkop". The disease attacks the respiratory system, especially during winter and is characterised by extreme swelling of the face. Initially the swelling is due to a clear subcutaneous oedema which at a later stage gives rise to thick yellow suppurations. Airsac infection, a not infrequent complication, contributes to mortality. It would seem that the condition is an infectious one, but so far attempts at isolating the causative organism(s) have not been successful. Serological investigations point to a possible influenza or infectious bronchitis virus involvement.

Considerable attention was paid to a respiratory disease among turkeys. When about 14 days old, poults develop severe rhinitis and sinusitis. Morbidity is very high and mortality up

to 20 per cent. Here again, an infectious organism seems to be involved, since the condition could be transmitted by the injection of sinus material into susceptible poults. Further research is being done in this regard.

The regional veterinary laboratory at Stellenbosch is continuing its investigations into the cause and prevention of the pathological condition known as "redgut" or "draaiderm". Whereas this disease used to be encountered only in the Swellendam State veterinary area, the condition has now been found in other parts of the Western Cape Region as well. In the Swellendam State veterinary area 12 000 sheep on 17 farms were immunised with a trial vaccine of *Clostridium perfringens* type A, manufactured by the Veterinary Research Institute. Preliminary results are not encouraging.

The survey on lung lesions in pigs is proceeding at the above laboratory; 20,55 % of the 13 634 pig carcasses examined exhibited lesions. The laboratory has demonstrated that *Mycoplasma pneumoniae* undoubtedly occurs in the Republic, and *M. hyopneumoniae*, *M. hyorhinus* and *M. hyosynoviae*, among others, have been isolated from lesions.

The regional veterinary laboratory at Middelburg (Cape) has proved that enzootic icterus is due to chronic copper poisoning and is focusing its attention on the possible source, prevention and treatment of the condition.

Investigations into the cause of "swelsiekte" in Angoras are proceeding, but are being hampered by the small number of cases presented for examination.

Experiments are still being conducted in conjunction with the Veterinary Research Institute in an attempt to solve the problem of "geeldikkop". The role played by fungi in the aetiology of the condition is being studied more closely at present.

The chemical composition of bladderstones and gravel in the urethra of rams is being determined, in cooperation with the CSIR, in an attempt to establish the cause and to introduce possible preventive measures.

The regional veterinary laboratory at Allerton, working in conjunction with the Durban City Council, has piloted a scheme to reduce the incidence of mastitis in dairy herds or eradicate the disease if possible. Regular visits to farms and bacteriological monitoring of milk specimens indicate that the condition is already under control in a large number of herds.

Research is still proceeding at the veterinary laboratory at Queenstown; the liver damage caused by seneciosis is established by means of blood tests. Preliminary results seem promising.

Research on game and diseases of game

Research is continuing in the Kruger National Park. A buffalo cow and two pregnant impala ewes were artificially infected during the year with the *Brucella* strain which had been isolated from a buffalo. All three animals aborted and it

was possible to isolate the organism from the three aborted fetuses.

However, the major portion of the work done at the veterinary laboratory at Skukuza concerned *foot-and-mouth* disease. The vaccine, which produced disappointing results in cattle, was injected into buffalo and impala, which developed "satisfactory" serological titres.

Buffalo in the Addo National Park were clinically examined for foot-and-mouth disease and throat scrapings for the isolation of the virus, together with blood samples for the determination of antibodies, were taken from them. The results, which were negative in all cases, make these the only known, free-living African buffalo which show no evidence of having had any previous contact with the foot-and-mouth virus. Buffalo in Natal have not been tested so far.

Artificial infection with foot-and-mouth was successfully induced in a young blue wildebeest, which had grown up in the animal holdings at Skukuza. Blue wildebeest of the same age, caught in the veld, could not be infected, however. Serological tests to establish the reason for this are under way.

A giraffe was injected with live foot-and-mouth virus to determine whether the animal would develop clinical lesions and whether it would transmit the disease to two other giraffe in the same camp. In both cases the results were positive. Throat scrapings and serum specimens from 13 giraffe in the Park, however, showed no evidence of either the virus or antibodies.

Sarcoptic mange was responsible for mortality among blue wildebeest in the Satara-Orpen-Nwanedzi complex. The condition was also found among giraffe, impala and lions in the same area. No cases were observed among buffalo during the year under review.

Actinomyces was again encountered in a number of impala in the southern parts of the Kruger National Park.

A hyena was experimentally infected with *Trichinella spiralis* and treated with mebendazole (2 g/day for 7 days). After 3½ months, when the animal was killed, it was still infected. *Trichinella* cysts were fed to mice and caused infection. Trichinosis could not be transmitted experimentally to 21 monkeys, a Cape hunting dog, a leopard and a python.

Two giraffe were infected with *papillomatosis* at Satara.

Internal parasites encountered either during meat inspections or at autopsies are listed below:

Pneumostrongylus spp. (lungworm) in the lungs of impala, *Stilesia hepatica* in the livers of impala, *Linguatula* spp. and *Sarcocystis* spp. in the carcasses of buffalo, *Fasciola* spp. in the livers of hippopotami, *Grammocephalus calthratius* in the lungs of elephants and *bladderworm infection* in the carcasses of impala and buffalo.

**SWART STATE
BLACK STATES**

- GAZANKULU
- LEBOWA
- VENDA
- NDEBELE
- KWAZULU
- BOPHUTHATSWANA
- QWAQWA
- TRANSKEI
- CISKEI
- GEBIED VOORLOPIG INGELYF
BY SWAZILAND

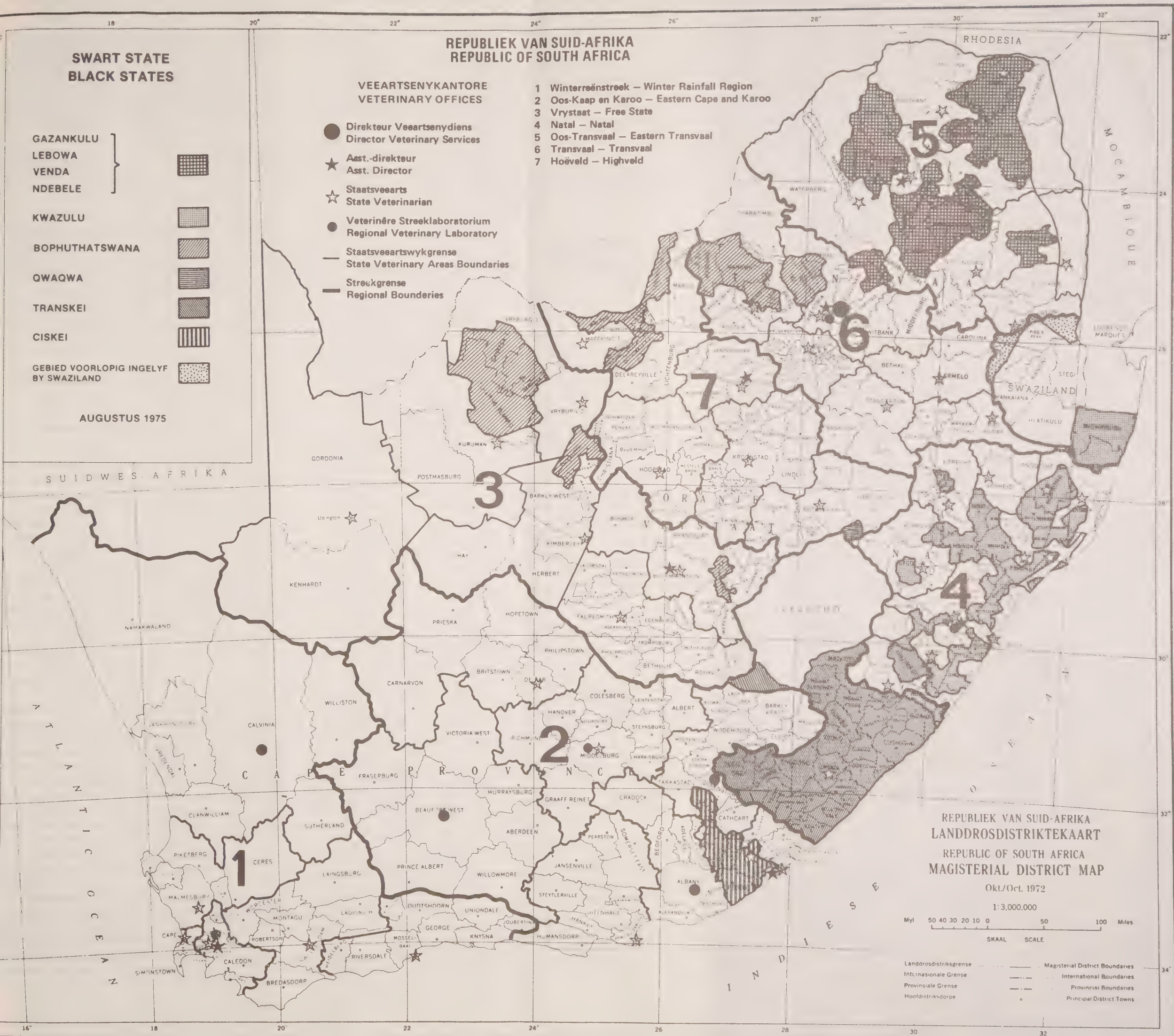
AUGUSTUS 1975

**REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA**

**VEEARTSENYKANTORE
VETERINARY OFFICES**

- Direkteur Veeartsenydiens
Director Veterinary Services
- ★ Aast.-direkteur
Asst. Director
- ☆ Staatsveearts
State Veterinarian
- Veterinêre Streeklaboratorium
Regional Veterinary Laboratory
- Staatsveeartswykgrense
State Veterinary Areas Boundaries
- Streekgrense
Regional Boundaries

- 1 Winterreënstreek — Winter Rainfall Region
- 2 Oos-Kaap en Karoo — Eastern Cape and Karoo
- 3 Vrystaat — Free State
- 4 Natal — Natal
- 5 Oos-Transvaal — Eastern Transvaal
- 6 Transvaal — Transvaal
- 7 Hoëveld — Highveld



**REPUBLIEK VAN SUID-AFRIKA
LANDDROSDISTRIKTEKAART
REPUBLIC OF SOUTH AFRICA
MAGISTERIAL DISTRICT MAP**

Okt./Ocl. 1972

1:3,000,000

Myl 50 40 30 20 10 0 50 100 Miles
SKAAL SCALE

- Landdrostdistriksgrense
- Internasionale Grense
- Provinsiale Grense
- Hoofdistrikdorpe
- Magisterial District Boundaries
- International Boundaries
- Provincial Boundaries
- Principal District Towns

VACCINES AND ANIMAL REMEDIES

The following vaccines were produced by State veterinarians, veterinary laboratories and/or regional veterinary laboratories:

Heartwater	8 915 doses
Autogenous wart	9 380 millilitres
Contagious pustular dermatitis (orf)	8 870 millilitres

The regional veterinary laboratory at Stellenbosch manufactured 270 ml of leptospirosis antigen, and 3 300 ml of *Brucella* antigen, 80 ml of antisera and 164 ml of complement were prepared at Middelburg (Cape), for own use.

No vaccine was confiscated and destroyed by officials of the Division of Veterinary Services, where the expiry date of the vaccine had been reached or the manufacturers' directions for storage had not been complied with.

CONTROL OF ANIMAL DISEASES

A. NOTIFIABLE DISEASES

(i) Foot-and-mouth disease

In addition to the three outbreaks of foot-and-mouth disease mentioned in last year's report, there were three further outbreaks this year, also caused by the SAT II strain of the virus.

At Barberton, the farms Steyn (13 July 1977), Grootdraai (18 July 1977) and Verdwaal (31 August 1977), in addition to Elsjan and Albert, became infected.

In the White River district (the Nsigazi area) a further 10 dipping tank areas, apart from the three mentioned in the previous report, became infected, the last being Lundi where the outbreak occurred on 28 October 1977.

In Letaba, the farms Schiettocht B (12 July 1977) and Muhale (2 August 1977) became infected in addition to Schiettocht (25 July 1977) and Genoeg (29 June 1977).

In Gazankulu (Giyani district) infection was confirmed in the Sabulani dipping tank area on 4 August 1977. Infection was encountered in a further 23 dipping tank areas. Kanaan was the last dipping tank area to become infected, and the outbreak occurred on 12 October 1977.

In the Bolobedu district in Lebowa infection was confirmed on 11 October 1977 at the Dumeri A dipping tank area. Subsequently, infection was also confirmed at Dumeri B on 13 October 1977 and at Sekoto on 19 October 1977.

Infection on the farm Calcutta, in the District of Mhala in Gazankulu, was confirmed on 28 February 1978.

Infection among impala in the Lower Sabie section of the Kruger National Park was confirmed only in October 1977. The SAT II strain of the virus was involved here as well. Clinical cases were still being encountered in the Kruger National Park towards the end of the year under review.

All the outbreaks in stock farming areas, with the exception of Bolobedu, were in the foot-and-mouth control area bordering on the Kruger National Park. Bolobedu, however, adjoins Giyani. Only cattle were affected.

The control measures which were described in the previous report were applied in all these outbreaks except at Calcutta. Vaccination, however, failed to produce the desired results and, notwithstanding repeated inoculations, the infection flared up several times. The reason is still being sought. In view of the ineffectiveness of vaccination, artificial virusing of the animals at Calcutta was decided on - in other words, they were artificially infected so that the disease could burn itself out. This measure had the desired result and there was no further spread of the disease.

In all these instances the infection was successfully eradicated and the campaigns wound up on the following dates: 31 October 1977 at Barberton, 18 January 1978 at Letaba, 28 February 1978 at Gazankulu (Giyani) and Lebowa and 31 May 1978 at White River and Gazankulu (Mhala). Normal control measures have since been applied.

During these campaigns a total of 563 877 cattle and 97 059 head of small stock were inoculated against foot-and-mouth disease. A total of 76 local officers and 97 officers from other parts of the country were used during the campaigns and 1 206 temporary labourers were employed.

In the Black states, the Department was responsible only for paying the salaries of its officers, all other expenses being met by the various Governments. The Department's outlay amounted to R761 724.

During these campaigns, the control measures included the destruction of animals whenever they strayed into or out of the infected areas or were illegally taken either into or out of such areas. No compensation was paid to the owners of these animals. In the White areas, 47 cattle, 1 sheep, 35 goats and 17 pigs, valued at R4 709, and in the Black states, 36 cattle, 3 sheep and 36 goats, with a total value of R3 885, were destroyed in this way.

The routine control measures for protecting stock farming areas against foot-and-mouth disease were once again in force at the end of the year under review. Since a reserve supply of vaccine was still available, 88 991 cattle were inoculated as a preventive measure during April 1978 with either a bivalent inactivated SAT I and SAT II vaccine or a trivalent inactivated SAT I, SAT II and SAT III vaccine. In view of the results obtained from immunisation during outbreaks of the disease, serious consideration will be given to the advisability of continuing with the annual preventive inoculation of cattle in the foot-and-mouth control area bordering on the Kruger National Park during the coming year.

The regular inspection of cattle by officers of the Division of Veterinary Services in the areas adjoining the Kruger National Park and the Botswana, Rhodesia and Mozambique borders is continuing. Stock fences and gameproof fences are

patrolled and maintained on the borders with these countries, and on the western, southern and northern borders of the Kruger National Park. The control of the portion of the fence between Botswana and Bophuthatswana was transferred to the latter country on 1 December 1977.

In the course of patrol work along the fences, 548 cattle, 29 goats and 2 sheep which had either been brought in illegally or had strayed in were found. All the animals, which were valued at a total of R5 798, except 487 cattle, which were returned to Botswana, were either slaughtered or destroyed, no compensation being paid to the owners.

(ii) Rabies

Of the 747 specimens submitted to the Veterinary Research Institute by the Division of Veterinary Services and the Black states, 185 (24,8 per cent) were positive for rabies. In the previous year 200 cases (22,9 per cent) were positive.

The incidence of the disease among the various animal species was:

Yellow mongooses	65
Cattle	46
Dogs	34
Species of wild cats	13
Domestic cats	8
Jackals	6
Skunks	4
Sheep	4
Horses	2
Goats	1
Humans	1
Mountain hares	1

Rabies is spreading southwards in Natal and the increase in the number of cases among domestic cats there is alarming. The same trend has been noted in kwaZulu and the single human case occurred there.

The rabies unit of the Division which had been giving assistance in Venda and Gazankulu was disbanded during the year because it was not being properly utilised.

Phostoxin tablets for exterminating mongooses were again supplied by the Division to farms where outbreaks had occurred. A total of 7 925 tablets were used to deal with 556 colonies and 1 116 individual holes in the Highveld Region of the Division.

As in the past, dogs in the proclaimed rabies areas of Natal and parts of the Northern and Eastern Transvaal were immunised against the disease, as well as dogs and cats within a radius of 15 to 25 kilometres of confirmed cases. In all 68 511 dogs and 4 856 cats in the White areas were immunised by officers of the Division of Veterinary Services, and 61 406 dogs and 1 618 cats were immunised in the Black states.

(iii) Anthrax

Three outbreaks of anthrax, which were responsible for the deaths of 3 cattle and 3 horses, occurred in the Republic during the year under review. In one of the outbreaks, in the Kimberley district, various species of game, mostly red hartebeest, succumbed to the disease.

In all 4 197 865 cattle and 9 967 head of small stock were immunised either by or under the supervision of officers of the Division of Veterinary Services as a preventive measure during outbreaks of the disease in the White areas. In the Black states 1 594 310 cattle were immunised as a preventive measure by officers of the various veterinary services. A few cases of the disease among impala were confirmed in the Pafuri area of the Kruger National Park.

(iv) East Coast fever and related diseases

East Coast fever (Theileria parva)

No cases have occurred in the Republic since 1954.

In Venda, Gazankulu and kwaZulu, where control measures against East Coast fever are still in force, 132 347 bovine spleen smears were examined.

Corridor disease (T. lawrencei)

One outbreak of the disease occurred in the Louis Trichardt State veterinary area, in the course of which 25 cattle died after a buffalo had grazed among the herd. The buffalo and seven others, which were subsequently shot, had presumably strayed from the Kruger National Park.

Restrictions on the movements of stock, an intensive dipping programme and the administration of antibiotics constitute the control measures applied.

There were again no cases in Natal or kwaZulu.

Benign bovine theileriosis (T. mutans)

In all, 30 cases (24 in Venda, 5 in kwaZulu and 1 in the Louis Trichardt State veterinary area) were diagnosed during the year.

(v) Tuberculosis

(Figures for the previous year are given in brackets).

During the year under review 3 843 (2 754) certificates were issued to tuberculosis-free herds, and 5 207 (4 830) herds participated in the bovine tuberculosis eradication scheme.

A total of 3 159 (4 390) positive reactors were slaughtered during the financial year which ended on 31 March 1978. The owners of these cattle received R611 782 (R899 885) by way of compensation.

Carcases not condemned for human consumption were sold for R367 381 (R512 810) and the moneys paid into Miscellaneous Revenue.

In terms of the scheme, R347 526 (R315 867) was paid to contracted private veterinarians for services rendered on behalf of the state. In all 393 (373) veterinarians have contracts with the State. A further sum of R28 912 (R28 426) for INH (isoniazid), ear tags and costs not covered by revenue from the slaughtering of positive reactors, brought the total outlay on the scheme to R988 221 (R1 244 179).

Since the scheme was initiated on 14 May 1969, 748 (629) previously infected herds have qualified for tuberculosis-free certificates. An additional 11 severely infected herds have been treated with INH, bringing the total up to 69 since the scheme was started. A summary of the tests carried out during the year is given below:

Test	No. of herd tests	No. of tuberculin tests	Reactions	
			Positive	Suspected
Accreditation	5 309 (4 997)	762 101 (683 176)	- (-)	674 (808)
Diagnostic	720 (391)	51 448 (15 474)	- (-)	62 (49)
Import	17 (34)	440 (255)	- (-)	- (-)
Export	86 (97)	2 405 (5 226)	- (-)	2 (1)
INH	77 (105)	18 507 (21 287)	248 (366)	194 (174)
Infected	756 (789)	165 159 (171 978)	2 621 (3 479)	533 (1 127)
Total	6 965 (6 413)	1 000 160 (897 396)	2 869 (3 845)	1 465 (2 189)

The percentage pf reactors, with the exception of tests on accredited herds, was 1,20 (1,77) % positive and 0,62 (1,02)% suspected. A further twenty-four members of the stock inspectorate staff were trained to carry out tuberculin tests.

A diagnostic herd testing scheme, in which exclusive use is made of officers to carry out the two prescribed tests on herds, was started during the year under review. 537 herds (55 612 animals) have already been tested in this way.) The 88 trained members of the stock inspectorate staff have played an important part in the progress achieved with the bovine tuberculosis eradication schemes.

In Lebowa 41 cattle were tested with tuberculin and not a single animal reacted to the test.

Cases of suspected tuberculosis in pigs are regularly encountered at abattoirs in the Transvaal Region.

Only one case of tuberculosis in poultry was reported; it occurred in the Kimberley State veterinary area.

(vi) Bovine brucellosis (*Brucella abortus*)

In accordance with the bovine brucellosis eradication scheme 600 509 (76/77 619 782) heifers over the age of three months but still under the age of 11 months were inoculated with Strain 19 vaccine in White areas either by or under the

supervision of officers of the Division of Veterinary Services. The corresponding number of inoculations in the Black states was 80 841.

In cases where infection was confirmed and written permission given by the State Veterinarian for the inoculation of females over the age of 11 months, 9 188 (76/77 1 514) females were vaccinated in White areas by or under the supervision of officers.

Since the voluntary accreditation scheme for bovine brucellosis was launched on 12 November 1976, 706 (76/77 51) herds, comprising a total of 61 306 animals, have joined it. Of these, 2 074 cattle (3,4 %) and 275 (39 %) herds were found positive after laboratory tests. The first brucellosis-free certificate was issued to a herd in the Highveld Region of the Division in June 1978.

The diagnostic scheme launched on 1 July 1977 has made good progress. A total of 110 354

animals from 2 087 herds were tested; 866 herds (41,5 %) and 7 287 animals (6,6 %) were positive. The latter percentage is probably a good reflection of the national incidence of brucellosis in cattle.

In every case, infected animals were branded with a "C" on the right side of the neck. The following tests for bovine brucellosis were carried out in terms of these schemes at the Veterinary Research Institute, regional veterinary laboratories and State veterinary offices:

Serological tests			
Tests	No. of tests	Results	
		Positive	Suspected
Rose-Bengal	131 702	13 086	-
		(9,94 %)	
Complement fixation	13 739	4 669	397 (0,29 %)
		(33,98 %)	
Tube agglutination	58 930	5 373	2 590 (4,4 %)
		(9,12 %)	

Milk tests		
Type of test	No. of tests	No. positive
Milk ring test	515	31
Isolation	92	4
Biological	31	2

Brucella abortus was isolated from 75 (15,37 %) of the 488 aborted cattle foetuses examined.

(vii) Trypanosomiasis

Nagana

No cases of nagana were diagnosed in the Republic. Cases of trypanosomiasis in both humans and animals, were, however, encountered in Caprivi.

As in the past, the Division of Veterinary Services conducted a spraying campaign against the tsetse fly on behalf of the Caprivi Government Services from June 1977 to September 1977.

Because of the constant menace of renewed incursions of tsetse flies from Botswana and Angola, it is not possible to eradicate the disease completely in Caprivi, but the spraying campaign at least helps to stabilise the position.

As in the past, an area of about 800 km² was sprayed by teams on foot with a 3,1 per cent water emulsion of dieldrin. The customary rise in the cost of the insecticide, transport and labour meant that the campaign this year cost R45 280, as compared with R38 585 the previous year.

No joint spraying was done in neighbouring countries, nor did the Interterritorial Committee for Tsetse Fly Control meet.

The organisation and control of spraying campaigns in the Caprivi will in future be the responsibility of the South West African authorities.

Dourine

Of the 1486 samples tested by the Veterinary Research Institute and the regional veterinary laboratory at Windhoek 57 (3,84%) were positive.

Positive stallions were either castrated or slaughtered and mares sterilised or slaughtered. No compensation was paid to the owners since the tests were carried out at their request.

(viii) Lumpy skin disease

Outbreaks (348) occurred in all the veterinary regions in the Republic except the Eastern Cape and Karoo Region. The outbreaks were particularly severe in the Transvaal and Natal Regions, mainly because farmers neglected to carry out preventive inoculation.

Officers of the Division immunised 290 611 animals against the disease during the year. The corresponding figure for Gazankulu and Venda is 34 243 animals.

(ix) Sheep scab

The number of outbreaks increased from 309 in 1976/77 to 320 in the year under review. Outbreaks occurred in 82 magisterial districts and gave rise to increasing concern. Negotiations with organised agricultural and other interested bodies will be continued during the coming year in an attempt to reach a decision regarding the obligatory dipping of all sheep.

Outbreaks occurred in every region of the

Division as well as in Lebowa, kwaZulu and the Ciskei. In the Black states alone there were 22 outbreaks of the disease in 5 magisterial districts.

The magisterial districts in which infection was confirmed, together with the number of outbreaks in each are as follows: Boshoff 26, Bultfontein 19, Kenhardt 18, Philippolis 17, Jacobsdal 13, Petrusburg 12, Harrismith 10, Gordonia 8, Dundee 8, Nqutu 8, Queenstown 8, Carnarvon 7, Estcourt 6, Pietersburg 6, Winburg 6, Wesselsbron 5, Madadeni 5, Herbert 5, Vryheid 5, Namaqualand 4, Brandfort 4, Jagersfontein 4, Kuruman 4, Hoopstad 4, Lichtenburg 4, Middelburg (Tvl) 4, Hewu 4, Koffiefontein 4, Nkandla 3, Witbank 3, Heidelberg 3, Lindley 3, Heilbron 3, Trompsburg 3, Indwe 3, Calvinia 3, King William's Town 2, De Aar 2, Britstown 2, Aliwal North 2, Bloemfontein 2, Clocolan 2, Dewetsdorp 2, Rouxville 2, Kimberley 2, Warrenton 2, Postmasburg 2, Belfast 2, Ficksburg 2, Koppies 2, Kroonstad 2, Reitz 2, Balfour 2, Springs 2, Bronkhorstspuit 2, Delmas 2, Pretoria 2, Nebo 2, Bethlehem 2, Benoni 1, Alberton 1, Amersfoort 1, Frankfort 1, Virginia 1, Ventersdorp 1, Ventersburg 1, Potchefstroom 1, Parys 1, Odendaalsrus 1, Klerksdorp 1, Hennenman 1, Fouriesburg 1, Christiana 1, Zastron 1, Fauresmith 1, Excelsior 1, Wodehouse 1, Prieska 1, Hopetown 1, Komga 1, Malmesbury 1 and Ceres 1.

As in the past, speculators and stock sales were largely responsible for spreading the disease.

In all, 1 130 360 head of small stock, 154 501 of which were in the Black states, on infected or contact farms, were dipped at least twice, with an interval of 8-10 days, in an approved dip, under official supervision.

(x) Mange

Cattle mange was rife in all the regions of the Division except in the Eastern Cape and Karoo and Northern and Eastern Transvaal Regions, where only a few cases were diagnosed. Mange was a problem in the high-lying areas of the latter Region.

The disease was a common problem in pigs in the Natal and the Northern and Eastern Transvaal Regions as well as in Venda and Gazankulu. In the Western Cape pig mange is increasing as a result of the fact that the efficacy of the available dipping fluids is causing problems. In the Transvaal Region the disease was common in the Pretoria and Rustenburg State veterinary areas. A few cases were reported in the Highveld and Eastern Cape and Karoo Regions.

Six outbreaks of goat mange occurred in the Msinga and Vulindlela districts in kwaZulu, and 13 331 goats were dipped as a preventive measure against the disease.

In the Transvaal Region a single outbreak of ovine mange occurred, during which 343 sheep were dipped to control the disease.

(xi) Swine fever

Classical swine fever does not occur in the Republic. Only one outbreak of African swine fever occurred in the swine fever control area of the Rustenburg State veterinary area. All four pigs involved died; consequently no pigs were slaughtered and no compensation was paid. The sties were thoroughly disinfected and movements to and from the infected farms prohibited.

The same control measures as before were applied in the swine fever control areas. There were 538 approved piggeries with 42 280 pigs in the White areas; in the Black states the corresponding figures were 12 and 599 respectively.

(xii) Swine erysipelas

Outbreaks of the disease, of which 42 were reported, occurred in all the Regions of the Division except the Eastern Cape and Karoo Region. Incidence was highest in the Western Cape (17 outbreaks) and Natal Regions (16 outbreaks). In the Kroonstad State veterinary area *Erysipelothrix rhusiopathiae*, besides causing the usual clinical signs, also caused abortions. The administration of antibiotics, together with improved hygiene and management practices and preventive inoculation, effectively controls the disease.

(xiii) Epizootic lymphangitis

One case of the disease was confirmed by the Veterinary Research Institute; it occurred in a horse from the Potgietersrus district.

The horse was killed, the stable thoroughly disinfected and movements to and from the farm where the outbreak occurred controlled. There were no further cases.

(xiv) Johne's disease

Six cases of the disease were confirmed during the year under review. Five of the animals were killed and an amount of R2 700 was paid to the owners in compensation. The sixth animal succumbed to the disease. As in the past, the cases occurred in imported animals and/or their progeny.

The farms where the disease was encountered, in addition to others where it had occurred in the past, were kept under observation for any further developments.

(xv) Infectious laryngotracheitis

One outbreak was confirmed in the Western Cape Region among laying hens which had not been immunised in the prescribed manner.

(xvi) Rinderpest

This disease does not occur in the Republic.

(xvii) Newcastle disease

Isolated outbreaks occurred in the whole Republic with the exception of the Western Cape and Eastern Cape and Karoo Regions and were generally the result of failure by farmers to follow the recommended inoculation programme.

The disease is rife in the Black states. In Lebowa the inoculation of poultry is obligatory, and 154 879 fowls were vaccinated by officers. In Venda 170 170 doses of vaccine were sold to farmers, and 7 733 fowls were immunised by officials in Qwaqwa.

(xiii) Bacillary white diarrhoea (BWD) and fowl typhoid

Of the 4 outbreaks of BWD reported during the year, one occurred in the Western Cape Region and the others in the Highveld Region. The outbreak in the Western Cape Region may be regarded as a recurrence of the disease, since all the carriers of the disease had not been eliminated at the time of the previous outbreak. Infected fowls were slaughtered by the owners, regular tests were carried out, management and hygiene practices improved and the outbreaks brought under control.

A single case of fowl typhoid was reported during the year, namely in the Natal Region. Here, too, the above control measures produced the desired effect.

(xix) Fowls cholera

No cases were reported.

(xx) Psittacosis

Two cases of psittacosis occurred in the Pretoria district. Movements to and from the holdings were controlled and the birds on the premises concerned treated.

The treatment of all imported birds is still a routine practice at the Jan Smuts quarantine station.

(xxi) Scrapie

No cases were reported.

(xxii) Equine infectious anaemia

No cases have been reported in the Republic since 1955.

(xxiii) Glanders

No cases have been reported in the Republic since 1945.

(xxiv) Contagious bovine pleuropneumonia

No occurrence of the disease in the Republic since 1924.

B. NON-NOTIFIABLE DISEASES

(i) Bacterial diseases

Mastitis

As in previous years, *Staphylococcus aureus* was the organism most commonly isolated from the milk of cows with mastitis. A trial vaccine, manufactured by the Veterinary Research Institute, was recently tested in Natal, with promising results. Other organisms which have played a causative role in mastitis are *Corynebacterium* spp., *Escherichia coli*, *Pseudomonas aeruginosa*, *Staph. epidermidis* and *Streptococcus* spp. Fewer cases than before were caused by *Pasteurella* spp.

In the bushveld areas of the country the bites of *Amblyomma* and *Hyalomma* ticks again created problems.

The fact that hygienic practices in most dairies in the Western Cape Region during the wet winters were below standard favoured the increase of the disease there. Besides isolating the causative organisms and offering advice on their control, officers of the regional veterinary laboratory at Stellenbosch are providing an extension service in order to improve management and hygiene in dairies.

Cases of *blue udder* occurred among sheep and goats in the Western Cape, Highveld, OFS and Eastern Cape and Karoo Regions of the Division. In the latter Region *Pasteurella haemolytica* was the commonest causative organism isolated from sheep. *Staph. aureus* was the commonest pathogen in goats, together with *Pasteurella haemolytica*. Both *Staph. aureus* and *Pasteurella* spp. played a part in the Highveld Region.

Enterotoxaemia (pulpy kidney)

Sporadic cases of pulpy kidney occurred in every Region, but chiefly where sheep had not been regularly or timeously immunised and the vaccine had not been administered or handled in the prescribed way. In the Western Cape Region, problems were experienced with the immunity induced by the oil-based vaccine and mortality from pulpy kidney occurred in inoculated sheep.

In the Ciskei officers immunised 192 820 sheep against the disease.

Black quarter

Sporadic cases of the disease were reported from the Western Cape Region where the disease occurred for the first time in the Malmesbury district, among cattle, and the Natal, OFS and Highveld Regions. In the Transvaal and Northern and Eastern Transvaal Regions it was rife among cattle, but in the Eastern Cape and Karoo Region sheep were mostly affected. In the latter Region only a few cases caused by *Clostridium chauvoei* were reported, but cases caused by *Clostridium septicum* and/or *Clostridium oedematiens* increased.

Cases of puerperal black quarter in sheep and goats, caused by *Cl. septicum*, occurred in the Louis Trichardt State veterinary area. In the Eastern Cape and Karoo and Free State Regions, *Cl. oedematiens* was involved in some cases of the disease, and in the Transvaal and Highveld Regions *Cl. septicum* was the cause of black quarter in an increasing number of cases.

Regular, precise use of the available vaccines is an effective preventive measure.

In Venda, Gazankulu and Lebowa the inoculation of cattle between the ages of 3 months and 3 years with the black quarter vaccine is obligatory, and 235 574 animals were immunised by officers during the year. In the Ciskei and kwaZulu officers immunised 213 359 cattle for farmers on a voluntary basis.

Botulism

A few cases of botulism occurred during the year. In the Transvaal Region there were 5 outbreaks, during which 75 cattle died in feedlots in which chicken manure had formed part of the ration.

No cases were reported in Natal, in contrast to the position last year. The only reported case among cattle in the Eastern Cape and Karoo Region occurred in the Queenstown State veterinary area. Eight animals died after they had been fed chopped lucerne which contained a tortoise shell.

Several cases of botulism among sheep were encountered in the Eastern Cape and Karoo Region and in the Calvinia State veterinary area. Mortalities ceased after the sheep had been immunised with the Onderstepoort botulism vaccine.

Problems were experienced with botulism in Venda, north of the Soutpansberg, and officers immunised 4 575 cattle against the disease.

Corynebacteriosis

As in the past, the disease was widespread, especially among sheep, throughout the Republic. Tick bites, wounds caused by grass seeds and shearing wounds which become contaminated with *Corynebacterium* spp. often give rise to abscesses. Brain abscesses ("bosluiskop") caused mortalities among goats in the East London and Barberton State veterinary areas.

If the available vaccines were correctly used and hygienic practices and management in general improved, the disease could be effectively controlled.

Pasteurellosis

This disease played a major part throughout the country. The number of cases in the Transvaal, Free State and Northern and Eastern Transvaal Regions dropped, except in goats north of the Soutpansberg. In the Western Cape Region the disease was responsible for retarded growth in calf

rearing units and caused mortality which varied from 5 to 20 per cent. Elsewhere most of the problems were experienced among lambs.

In Lebowa pasteurellosis was responsible for mortality among pigs in the Moutse district.

Tetanus (lockjaw)

As in the past, a few cases of this disease occurred throughout the Republic. In every case reported the elastrator, which is used for castrations or docking the tails of lambs, was involved. This technique is gradually being phased out in the Highveld Region where, among others, 8 bull calves died from lockjaw after the elastrator had been used for castration.

Colibacillosis

Sporadic cases of colibacillosis were reported in the Free State and Northern and Eastern Transvaal Regions. The disease was especially common among pigs in the Highveld, Transvaal and Western Cape Regions. Many calves developed the disease in the Stellenbosch, Malmesbury and Grahamstown State veterinary areas. The regional veterinary laboratory at Stellenbosch isolated various strains of *Escherichia coli* which had not been incorporated in the existing vaccine. Special vaccines had to be prepared in these instances. Calf rearing units in the Western Cape Region should face East and not North because of the climatic conditions in that area.

In kwaZulu the condition is fairly common among calves that are penned in wet, dirty kraals during the day.

Leptospirosis

Cases were reported only from the Highveld Region among cattle in the Potchefstroom district and the Western Cape Region (among pigs). In the latter Region a trial vaccine was tested in 6 piggeries and gave very promising results.

***Pseudomonas* infection**

A few cases of green fleece staining caused by the organism were encountered by the regional veterinary laboratory at Middelburg (Cape).

Actinobacillosis and actinomycosis

A few cases of these diseases were diagnosed in the Natal (actinomycosis was diagnosed only in the Ixopo State veterinary area), Western Cape (in feedlots, among cattle from South-West Africa), Eastern Cape and Karoo, Northern and Eastern Transvaal (among cattle in the Louis Trichardt State veterinary area, actinomycosis among impala in the Kruger National Park) and Highveld Regions (in the Lichtenburg and Potchefstroom districts).

Foot-rot and foot abscess

Foot abscess was widespread, particularly among sheep, in the Natal Region. Similar problems with foot-rot among cattle were experienced during the winter in the Western Cape Region. The number of cases of foot abscess in the Eastern Cape and Karoo Region decreased with the drier conditions in those parts this year. There were sporadic cases in the Free State, Northern and Eastern Transvaal and Highveld Regions. In the Highveld Region the condition was widespread among sheep in the Marico district.

In Venda and Gazankulu foot-rot was common among cattle and foot abscess occurred among sheep and goats in kwaZulu.

Strangles

A few cases of the disease were diagnosed in the Vryheid and Ixopo State veterinary areas. Serious problems were experienced with the disease in the Ceres district, but a *Streptococcus equi* trial vaccine issued by the Veterinary Research Institute was the answer to the problem.

Lamb dysentery

Only a few cases were reported by the State veterinarian of Queenstown, or from the Free State Region.

Listeriosis

Two cases in sheep were confirmed during post mortems by the regional veterinary laboratory at Stellenbosch.

(ii) Protozoal diseases

Babesiosis

Redwater was prevalent in all the Regions except the Highveld Region, where problems were experienced only in the Marico, Potchefstroom and Klerksdorp districts. The disease was again the commonest cause of mortality in Natal. *Babesia bovis* was responsible for the majority of cases in the Transvaal Region and caused the death of 418 cattle in confirmed outbreaks of redwater in the Piet Retief State veterinary area. The disease plays a more important part in the Lydenburg and Barberton State veterinary area than in the other parts of the Northern and Eastern Transvaal Region. Babesiosis commonly occurs where cattle are brought into these parts from other parts of the country. Redwater has become established in the Karoo section of the Eastern Cape and Karoo Region.

In kwaZulu the number of cases of redwater dropped considerably as a result of more effective dipping of cattle. A few cases were confirmed in the Ritavi and Mhala districts of Gazankulu.

Biliary fever in dogs reached serious proportions, especially in the Free State, Western Cape and Northern and Eastern Transvaal Regions. Some cases of equine biliary were encountered in

the Stellenbosch State veterinary area, and one case of *Babesia felis* infection was diagnosed in a cat at Messina.

Anaplasmosis (gallsickness)

A few cases of the disease were encountered in the Transvaal Region and kwaZulu. Anaplasmosis is the commonest disease of cattle in the Highveld Region, and cases have even been reported in herds that had been immunised for a second time. Unless treatment is started immediately with high dosages of drugs, cattle succumb to the disease. Its incidence is higher in the Free State Region than that of redwater, and the disease is more important than redwater in the Louis Trichardt and Potgietersrus State veterinary areas. The disease has now become established in the Karoo section of the Eastern Cape and Karoo Region and is common in the Western Cape and Natal Regions.

Besnoitiosis (elephant skin disease)

The disease was widespread in the Transvaal and Northern and Eastern Transvaal Regions, since insufficient use was made by farmers of the available vaccine. A few cases occurred in the Marico district.

In Lebowa, where the disease was prevalent in the Mokerong, Mapulaneng, Bochum and Moutse districts, 250 cattle were immunised by officers. Cases of the disease were also reported from the Giyani district of Gazankulu.

Coccidiosis

Cases of coccidiosis occurred among calves and lambs throughout the country, especially where the animals are maintained on cultivated pastures. The disease was rife among poultry in the Highveld, Free State and Eastern Cape and Karoo Regions, and serious problems were encountered among Angora goats in the Eastern Cape and Karoo Region.

(iii) Virus diseases

Bluetongue

There were again serious outbreaks of bluetongue in the Transvaal (Ermelo and Standerton State veterinary areas), Highveld (especially the Northern Free State), Free State (widespread throughout) and the Eastern Cape and Karoo Regions.

The fact that the supplementary vaccine which contains additional strains of the virus was usually not administered was a contributory factor. Vaccine distributors often fail to provide pamphlets with the vaccine and many farmers were therefore unaware of the existence of such a vaccine.

There were a few cases of the disease in the Western Cape Region; in the Northern and Eastern Transvaal Region cases were reported only from the Lydenburg State veterinary area. Few problems

were experienced with the disease in Natal, except in the Drakensberg, where it was frequently encountered. The disease used to be rare in this area.

In the Ciskei officers immunised 202 496 sheep against the disease.

African horsesickness

Isolated cases of the disease occurred throughout the Republic except in the Pietermaritzburg State veterinary area, where 1 381 cases were noted. In practically every case the horses had not been inoculated.

Heartwater

Heartwater took its usual toll in the areas where it is endemic. It caused higher mortality than any other cattle disease in the Rustenburg, Louis Trichardt and Potgietersrus State veterinary areas. The disease has now become established in the Mafeking district and in parts of the Natal Midlands. When cattle that were infected with bont ticks were moved to the Potchefstroom district by a speculator the result was an outbreak of heartwater.

Ephemeral fever (three-day stiffness)

The disease reached epizootic proportions in the Western Cape Region. Deaths were fairly common, particularly among Jerseys, and there were several cases of abortion. The disease was very prevalent in the Free State and Eastern Cape and Karoo Regions, where it occurred in a severe form. The production losses in both inoculated and uninoculated herds were enormous. Cases were sporadic in the rest of the country.

The available vaccine was subsequently withdrawn by the Veterinary Research Institute since it had failed to induce adequate immunity.

Rift Valley fever and Wesselsbron disease

A few cases of Rift Valley fever occurred in the Free State and Eastern Cape and Karoo Regions.

Bovine malignant catarrh

Twenty-two outbreaks of the disease, accounting for 43 deaths among cattle, occurred in the Transvaal (5 outbreaks), Free State (2 outbreaks), Natal (10 outbreaks) and Northern and Eastern Transvaal (5 outbreaks) Regions. In every case in which sheep were involved, except one in the Transvaal Region and one in the Free State Region, there had been contact with blue wildebeest.

Pulmonary adenomatosis (jaagsiekte)

Fourteen outbreaks of pulmonary adenomatosis (jaagsiekte) were reported during the year. The disease was confirmed in the Lydenburg

State veterinary area for the first time, while two outbreaks occurred in the Free State Region and two in the Ermelo State veterinary area. There were eight outbreaks of the disease in the Queenstown State veterinary area and one in the Namaqualand district. Further tests with a trial vaccine were carried out in the Lydenburg State veterinary area.

Infectious ophthalmia

The disease was widespread in the Rustenburg State veterinary area, as many as 30 per cent of the animals in one herd being affected, while cases were also reported from the Free State, Natal, Eastern Cape and Karoo and Western Cape (among sheep) Regions. The disease was also widespread in the Highveld Region and in some outbreaks treatment had to be given as often as three times a day before the situation could be brought under control. Sporadic cases occurred among sheep and cattle in the Northern and Eastern Transvaal Region and among cattle in Venda and Gazankulu.

Contagious pustular dermatitis (vuilbek, orf)

There were sporadic outbreaks in the Transvaal, Highveld, Free State, Western Cape and Northern and Eastern Transvaal Regions. In the Pietermaritzburg and Dundee State veterinary areas serious outbreaks occurred which accounted for considerable losses among lambs. The disease was fairly prevalent in the Eastern Cape and Karoo Region and caused problems among goats in kwaZulu.

Mucosal disease

No cases were reported.

Infectious bovine rhinotracheitis

In the Transvaal Region cases of the disease were again confirmed among bulls at the Irene bull testing station and in feedlots.

Akabane virus

The virus was isolated from cases in the Grahamstown State veterinary area and antibodies against this virus were discovered in serum from the Louis Trichardt State veterinary area.

Feline infectious enteritis

The only confirmed cases occurred in coastal areas and in the Grahamstown State veterinary area in the Eastern Cape and Karoo Region.

(iv) Fungal diseases

Ringworm

Sporadic cases of ringworm occurred in the Transvaal, Natal, Eastern Cape and Karoo and Western Cape Regions. In the latter two Regions the disease was diagnosed in all animal species. It was common among calves and Karakul rams in the

Free State Region and a few cases were encountered in Venda and Gazankulu.

Lumpy wool

Outbreaks of lumpy wool were prevalent in the Western Cape Region, particularly in the Swellendam State veterinary area. A few cases were confirmed in the following Regions: Transvaal, mainly in the Piet Retief State veterinary area, Highveld (Kroonstad district), Free State, Natal and Western Cape.

Streptothricosis (Senkobo)

Single outbreaks were confirmed in the Noupoort and Queenstown districts.

(v) Infertility and venereal diseases

Infertility problems were reported from all the Regions of the Division of Veterinary Services. Malnutrition, poor management and venereal diseases all played a greater or lesser role and the result was a poor calf and lamb crop.

Owing to good rains during 1976/77, the calving percentage rose from 43,5% to 54,3% in Venda, and from 46,7% to 68,6% in Gazankulu.

The percentage in kwaZulu remained below 40%.

Vibriosis

The disease was again diagnosed in all the Regions. An examination of the sheath washings of 2 959 bulls showed that 129 (4,36%) were positive for vibriosis, while *Campylobacter fetus* was isolated from 13 (2,7%) of the 488 cattle foetuses examined.

If the available vaccine is correctly used the disease can be successfully controlled.

Trichomoniasis

Trichomoniasis was also diagnosed in all the Regions as a cause of reproduction problems; it also occurred in Venda. Sheath washings were examined by the Veterinary Research Institute, regional veterinary laboratories and veterinary laboratories and 80 out of the 2 959 (2,7%) examined were positive for trichomoniasis. The State veterinarian at Louis Trichardt found that 10 (3,5%) out of the 285 washings examined were positive.

Trichomonas foetus was isolated from a single bovine foetus out of the 488 examined.

The disease is a greater threat in Natal than vibriosis.

Chlamydiosis

Considerably fewer cases of abortions attributable to *Chlamydia psittaci* were reported this year, though cases still occur throughout the country. The organism was isolated from 28 (5,7%) of the 488 bovine foetuses examined. In the Western Cape Region the disease was responsible

for 15 % of all neonatal losses, and stunted growth, particularly among lambs, resulted in economic losses in all the Regions.

Actinobacillus seminis

The regional veterinary laboratory at Middelburg (Cape) examined 5 111 serum samples from sheep and 190 from goats in the Western Cape, Eastern Cape and Karoo, Free State and Transvaal Regions. In the Western Cape Region alone, 4 024 rams were tested for infection with the organism and of these 188 (4,7 %) were positive, and 23 (11,3 %) of the 203 samples examined were positive in the Highveld Region.

Every year, therefore, a considerable number of farmers lose lambs as a result of the use of infected rams. As many as 20 % of the marketable rams of some breeders are infected.

Brucella ovis

Of the 9 209 samples submitted for examination in the Western Cape and Eastern Cape and Karoo Regions, 626 (6,8 %) were positive for *Brucella ovis*. Ninety-two (9,9 %) of the 927 samples examined at Middelburg (Cape) from the Upington State veterinary area were positive for *B. ovis*. Farmers are not making sufficient use of the available Rev. I vaccine which gives excellent results.

Infectious epididymitis/vaginitis ("epivag")

This condition was encountered in cattle in the Transvaal (Ermelo State veterinary area), Free State (endemic in the Vryburg State veterinary area) and Western Cape Regions.

(vi) Diseases of calves

White scours

Infection with *Escherichia coli* caused sporadic cases of white scours in the Transvaal, Northern and Eastern Transvaal and Eastern Cape and Karoo Regions. The disease was especially prevalent in the Vryburg State veterinary area and in calf rearing units in the Stellenbosch and Malmesbury State veterinary areas. The disease was also a general problem in Natal and kwaZulu.

Various strains of *E. coli*, not included in the present vaccine, were isolated in the Western Cape Region. These strains were used for the manufacture of special vaccines, which have been used with good results.

Poor hygiene and management were a causative factor in all the Regions during outbreaks of the disease. The necessary attention to these aspects and the correct use of the vaccine have produced good results.

Paratyphoid

Sporadic cases of this disease occurred in all the Regions except in the Natal (where there were even cases in the Bushveld areas) and Western

Cape Regions, where it was prevalent.

In the Western Cape Region this disease was the most important disease of calves after white scours. *Salmonella dublin* and *S. typhimurium* were the commonest causative organisms. Cases among 2-6 - day-old calves occurred frequently and this complicated the prevention of the disease.

Calf diphtheria

A few cases of the disease were diagnosed in the Free State Region and the Potchefstroom district.

Sweating sickness

Fewer cases of sweating sickness were encountered this year in the Transvaal and Natal Regions than in the previous year. Sporadic cases were reported from the Highveld, Free State and Northern and Eastern Transvaal Regions, as well as from Venda and Gazankulu. The disease was also prevalent in the Kroonstad, Vryburg and Kuruman State veterinary areas.

Enteroviruses

The Veterinary Research Institute isolated Rota and Corona viruses from calves in the Western Cape Region.

(vii) Diseases of poultry

The volume of work of the Poultry Diagnostic and Extension Services Section of the Division of Veterinary Services at Onderstepoort decreased during the year under review, partly owing to the present economic climate, which has resulted in the take-over of a considerable number of the smaller concerns by the larger companies with their own primary diagnostic services. The Section is, however, still being used for more sophisticated techniques.

With the intensification in the poultry industry, respiratory diseases have become increasingly important.

Infectious bronchitis

A few outbreaks among broilers were reported from the Western Cape and Natal Regions.

A respiratory disease known as "dikkop", to which broilers are particularly susceptible, is causing some concern in the poultry industry. It occurs mainly during winter; the symptoms are a swollen face, subcutaneous oedema and eventually yellow pus in the subcutaneous tissues of the head. The cause of the disease is still unknown, but an influenza virus or even a strain of the infectious bronchitis virus is regarded as a possible cause, and the Section for Poultry Diagnostic and Extension Services is investigating the condition.

Infectious coryza

A few cases of the disease were confirmed in the Highveld Region and in the Queenstown and Port Elizabeth State veterinary areas. There was only one confirmed outbreak in Natal. The available vaccine provides excellent protection if it is used in the prescribed manner.

Chronic respiratory disease (mycoplasmosis)

The disease was widespread throughout the Republic, occurring mostly on the smaller farms. Ninety-eight cases of *Mycoplasma gallisepticum* infection and 47 cases of *Mycoplasma synoviae* infection were confirmed in the Western Cape Region. Of the 6 982 serological tests carried out in this Region, 604 (8,65 %) were positive for *M. gallisepticum* and 587 (8,41 %) for *M. synoviae*.

The Poultry Diagnostic and Extension Services Section at Onderstepoort noted an increase in the number of *M. synoviae* isolations. This organism was involved, *inter alia*, in cases where egg production dropped and air sac infections occurred.

Fowl pox

Sporadic outbreaks of fowl pox were confirmed in the Natal and Free State Regions. Several outbreaks occurred in the Port Elizabeth State veterinary area and one outbreak each in the Namaqualand and Malmesbury districts.

Infectious bursitis (Gumboro)

One outbreak was diagnosed in the Highveld Region and one in the Natal Region. The disease was widespread in the Western Cape Region but losses were small.

Epidemic tremor

No cases were reported.

Marek's disease

A considerable number of cases were observed by the Poultry Diagnostic and Extension Services Section during the year. A few cases were diagnosed in the Natal, Highveld and Western Cape Regions.

Lymphoid leukosis complex

Cases were diagnosed at the Glen Agricultural College, among others.

Trichomoniasis

A few cases were encountered among racing pigeons in the Port Elizabeth State veterinary area.

(viii) Diseases of pigs

Vibronic dysentery

The Stellenbosch regional veterinary laboratory confirmed 11 cases of the disease.

Treatment with antibiotics and improved management practices were successful in controlling the outbreaks.

Respiratory disease syndrome

The regional veterinary laboratory at Stellenbosch confirmed the presence of mycoplasma pneumonia in South Africa. In addition to *Mycoplasma hyopneumoniae*, *M. hyorhinis* and *M. hyosynoviae*, unidentifiable *Mycoplasma* spp. were isolated from cases.

The six outbreaks investigated during the year under review were speedily brought under control by the addition of antibiotics to the rations and by correcting housing faults.

Spirochaetosis

A single outbreak, involving 15 pigs, was confirmed in the Barberton State veterinary area.

C. DEFICIENCY AND NUTRITIONAL CONDITIONS

Fewer problems due to malnutrition were encountered than usual, since sufficient good grazing was available after adequate rains.

Phosphate deficiency was common in cattle during the winter months in the Highveld, especially in the sandy northern areas, in the sandy area of Malmesbury and the coastal areas of the Eastern Cape and Karoo Region.

Bladder stones caused problems among rams in the Middelburg and Queenstown State veterinary areas, where the phosphate content of the rations was too high.

Seasonal *copper* deficiency occurred in Natal. Swayback took its usual toll in the Malmesbury and Swellendam State veterinary areas, and cases were also reported from the Grahamstown and Port Elizabeth State veterinary areas. Copper deficiency also occurred among cattle and sheep in the Bethlehem State veterinary area, and a single case was confirmed in cattle in the Ermelo State veterinary area.

Magnesium deficiencies were encountered again in the Free State Region and in the Bethlehem State veterinary area on heavily fertilised green grazing, and occurred in Natal, in the Vryheid and Dundee State veterinary areas, on natural grazing. Dosing with magnesium sulphate increased the calving percentage from 50 to 95 per cent. This deficiency caused problems among Jerseys at the Elsenburg College of Agriculture. Livestock, mainly cattle, were affected in the Queenstown State veterinary area, also on natural grazing. In the Louis Trichardt State veterinary area magnesium deficiency was confirmed in cattle at Alldays.

Manganese deficiency gave rise to problems in the Montagu, Messina (Tshipise area) and Bethlehem districts as well as on a farm in the Ermelo State veterinary area.

Iodine deficiencies were confirmed in the central parts of Natal and in the Drakensberg, and cattle in the Pietersburg State veterinary area showed typical deficiency symptoms. The regional veterinary laboratory at Allerton is at present carrying out iodine determinations on up to 100 samples a day. The only other place where determinations of this type are done is a SABS laboratory in Pretoria.

Problems caused by *cobalt deficiency* were reported from the Port Elizabeth State veterinary area only.

Zinc deficiency was confirmed in the Montagu and Swellendam districts. The zinc values found in samples from the Messina (Tshipise area) and Soutpansberg (Alldays) districts were above what is generally regarded as normal.

An *iron deficiency* reported in Alldays among cattle was corrected by means of licks. The values in the Tshipise area were again above normal.

A *Vitamin A* deficiency in the Western Cape Region led to blindness in goats, a problem that was resolved when the animals were dosed with fish oil. Abortions among Boer goats in the Eastern Cape and Karoo Region were attributed to, *inter alia*, Vitamin A deficiency. These abortions ceased dramatically after the administration of Vitamin A.

Some cases of a *Vitamin E* deficiency among chickens were diagnosed in the Highveld and Free State Regions and in the Louis Trichardt State veterinary area. In every case the ration had been badly stored and the Vitamin E content consequently oxidised. White muscle disease (Vitamin E - *selenium*-deficiency) occurred among lambs in the Marico district but gave no further trouble after treatment. Several cases of white muscle disease among calves were confirmed in the Pretoria State veterinary area.

A few cases of *milk fever* were encountered in the Free State Region, Middelburg State veterinary area and the Western Cape Region (where sheep had grazed self-sown wheat and been moved to another camp afterwards. On one farm in the Malmesbury district, 120 young rams developed "bowie", as it is known, on cultivated pastures.

A considerable number of cases of *pregnancy toxæmia* (domsiekte) were reported in both the Western Cape Region and the following State veterinary areas: Middelburg (Cape), Queenstown, Upington and Bloemfontein.

A few cases of *acidosis* occurred in the Free State and Natal Regions (as a result of pineapple cores in the feed).

The Queenstown State veterinary area is the only area from which cases of *ketosis* were reported.

D. POISONING

Mineral poisoning

Carelessness or the accidental intake of poison again accounted for most cases of mineral poisoning in all parts of the Republic. A few cases

of *arsenic* poisoning were confirmed in the Free State, Northern and Eastern Transvaal, Eastern Cape and Karoo and Western Cape Regions. In the latter Region, 45 sheep in the Caledon district died after a lick had been incorrectly constituted.

Chlorinated hydrocarbons caused mortality in the Highveld, Northern and Eastern Transvaal, Free State and Natal Regions. Fifteen cattle died in the Soutpansberg district. In the majority of cases weedkillers were erroneously used for dipping.

An *organophosphatic* pesticide accounted for the deaths of four cattle in the Highveld Region when it was confused with a dip, and dieldrin for the deaths of 20 cows in the Heilbron district. Dieldrin poisoning was also reported from the Bethlehem State veterinary area. In one case, five out of ten horses died when dieldrin got into the ration. In the Western Cape Region lambs died after they had suckled ewes which had just been dipped and were still wet. In the Molteno district two cattle died from *toxaphene* poisoning.

Pentachlorophenol was responsible for the deaths of 48 pigs in the Transvaal Region, and 15 sheep succumbed to salt poisoning in the Western Cape Region.

The toll taken by *nitrate* poisoning was not as high as in previous years. Only two cases were reported in the Free State Region, where the high nitrate content of bore-hole water regularly causes poisoning. A few cases also occurred in the Natal Region and Middelburg and Queenstown State veterinary areas. Ammonium sulphate in the ration accounted for the deaths of 13 cattle in the Transvaal Region.

Thirty-nine sheep in the Swellendam district died of *sulphur* poisoning as a result of a lick with too high a sulphur content.

Urea poisoning caused mortality in all the Regions. In the Western Cape Region 450 sheep (on five farms) died after the licks had been saturated by an unexpected shower of rain. Urea fed to them from a sack was responsible for the deaths of 110 fowls out of a flock of 200 in the Transvaal Region.

Lead poisoning was confirmed among cattle in the Transvaal Region (10 pedigree cows died in one instance) and in the Highveld and Natal Regions, as well as in Lebowa.

The incidence of *enzootic icterus* (chronic copper poisoning) was the subject of a survey in the Middelburg State veterinary area. A total of 1 118 sheep on 21 farms died from this condition and staff of the regional veterinary laboratory at Middelburg (Cape) devoted much time to an investigation of the prevention and control of *enzootic icterus*. Fifty sheep succumbed to this condition in a feedlot in the Laingsburg district.

Strychnine poisoning again caused the death of dogs throughout the Republic.

Plant poisoning

According to reports from all the Regions and Black states, the plants listed below were

responsible for stock deaths. In the Western Cape Region, where there was a serious drought during the second half of the year under review, more cases of plant poisoning were experienced than in the rest of the Republic.

Homeria and *Moraea* spp. (tulip) in all seven Regions; *Urginea* and *Ornithoglossum* spp. (slangkop) in the Free State, Highveld, Natal and Western Cape Regions; *Senecio* spp. (sprinkaanbos) in the Western Cape, Natal (particularly in the Ixopo State veterinary area) and the Eastern Cape and Karoo Regions (of particular importance in the Queenstown State veterinary area); *Pachystigma*, *Pavetta* and *Fadogia* spp. (gousiekte) in the Northern and Eastern Transvaal (Potgietersrus State veterinary area), Transvaal and Highveld (Marico and Viljoenskroon districts) Regions; *Lantana camara* in the Natal, Transvaal (Rustenburg State veterinary area) and the Northern and Eastern Transvaal Regions (30 sheep and 20 cattle died in the Pietersburg State veterinary area); *Dichapetalum cymosum* (gifblaar) in the Transvaal, Northern and Eastern Transvaal (Potgietersrus State veterinary area) and Highveld Regions (Marico district); *Datura* spp. in the Western Cape and Natal Regions; *Geigeria* spp. in the Free State (on the increase in the western parts of the Region) and Highveld Regions; *Crotolaria* spp. (duinebos, rattle bush); *Cestrum laevigatum* (inkberry), *Indigofera tryptantha* (caused stiff-sickness symptoms among cattle in the Ventersdorp district, but non-toxic in the dry form) and *Raphanus raphanistrum* (wild mustard) (among sheep in the Potchefstroom district) in the Highveld Region; *Matricaria* spp. (staggers), *Ricinus communis* (castor oil) in the Natal Region; *Ornithogalum* spp. in the Transvaal Region (17 cattle died in the Rustenburg State Veterinary area); *Chrysocoma tenuifolia* (kaalsiekte, bitter Karoo) and *Lasiospermum* spp. (ganskweek) in the Eastern Cape and Karoo Region; *Amaranthus* spp. in the Free State Region and *Cotyledon* spp. (krimpsiekte), *Asaemia axillaris* (vuursiekte), *Cynachum* spp. (klimop, bobbejaantou), *Sarcostemma viminalis* (climbing milkweed), *Melianthus major* (honey flower), *Galaenia africana* (waterpens), *Kalanchoë* spp., *Echium capensis* (blue weed) and *Atisoma capensis* in the Western Cape Region.

The only cases of "geeldikkop" were a few in the Eastern Cape and Karoo Region. Cases of "dikkop" without jaundice occurred in the Highveld and Western Cape Regions.

Plants containing *prussic acid* caused deaths in all the Regions except the Transvaal, Western Cape and Natal Regions.

Toxins

The incidence of *Diplodia maydis* poisoning was high in the Potchefstroom district, where more than 300 cattle were affected by the condition.

Cases of *facial eczema* were confirmed in the Eastern Cape and Karoo Region.

A SA Mutton Merino stud farmer suffered major losses among his flock in the Malmesbury district. The regional veterinary laboratory at Stellenbosch isolated the fungus *Stachybotrus atra* from the sheep pellets and demonstrated that a toxin formed by the fungus was responsible for the condition. Affected sheep showed high temperatures, epistaxis and mild diarrhoea. A lowered haematocrit, white cell and blood platelet count were also experienced later. Blood transfusions combined with antibiotic therapy effected a recovery in 15 affected sheep.

E. INTERNAL PARASITES

Serious problems with internal parasites were reported only from the Highveld Region, where they occurred mainly in sheep.

Haemonchus spp. (wireworm) was the parasite which caused most problems in the Transvaal Region (with the exception of the Rustenburg and Johannesburg State veterinary areas), the Highveld Region (together with nodular worm), the Free State Region where there was evidence that the parasite had begun to develop a resistance (similar to the resistance reported from the South-Eastern Transvaal the previous year) to certain remedies and the Natal Region (together with nodular worm), as well as in Venda and Gazankulu. In the Northern and Eastern Transvaal Region the parasite was only of importance in sheep.

Oesophagostomum spp. (nodular worm), together with wireworm as mentioned above, was the most important internal parasite in the Highveld and Natal Regions, as in 1976/77. Problems were also experienced with the species in the Free State and Northern and Eastern Transvaal Regions (among sheep).

Trichostrongylus spp. (bankrupt worm) was responsible for losses in the Free State and Eastern Cape and Karoo Regions.

The brown stomach worm *Ostertagia* spp. accounted for losses in the Eastern Cape and Karoo, Western Cape and Natal Regions.

The long-necked bankrupt worm *Nematodirus* spp. was a major problem in the Western Cape and Eastern Cape and Karoo Regions.

Trichuris ovis (whipworm) occurred only in the Free State Region.

Lungworm *Muellerius capillaris* was a problem only in the Natal Region and in the Queenstown State veterinary area.

Fasciola spp. (liver fluke) was fairly prevalent in the Transvaal, Natal and Highveld Regions (especially among sheep in the Potchefstroom, Lichtenburg and Bethlehem State veterinary areas). In the Northern and Eastern Transvaal Region this parasite caused problems in all the State veterinary areas except Pietersburg and Barberton. Infestations were also confirmed in the Free State Region and the Queenstown State veterinary area.

At the Durban abattoir 17,8% of the bovine livers and 3,6% of the sheep livers were condemned

for human consumption on account of liver fluke infestation. At Rustenburg 54 % of the livers were similarly condemned.

During the year under review, unlike the previous year, conical fluke *Paramphistoma* spp. was a problem only in the Highveld (mainly in the Lichtenburg, Kroonstad and Bethlehem State veterinary areas), Free State and Natal Regions.

Tapeworm infestation in both calves and lambs was very prevalent in kwaZulu and the Natal Region. Calves were severely infested in the Marico district, and several cases of tapeworm infestation were confirmed in the Free State, Western Cape and Eastern Cape and Karoo Regions.

Stilesia hepatica (liver tapeworm) accounted for the condemnation of 26 % of all livers in the Transvaal Region, while 19 % of the sheep livers in Natal were condemned at the Durban abattoir.

This infestation was prevalent in all the Regions except the Western Cape Region.

Oestrus ovis (nasal worm) infestation occurred in the Highveld (where it was widespread) and Western Cape Regions.

Coenurus cerebralis gave rise to problems in the Western Cape and Eastern Cape and Karoo Regions.

Carcases are still frequently condemned because of *measles* infestation. Four per cent of beef carcases and 0,5 % of pork carcases were condemned in the Transvaal Region. The figure for beef carcases in the Free State Region was 2 % and that for the Northern and Eastern Transvaal Region 4 %.

The incidence of *Parafilaria bovicola* infestation is on the increase in the northern parts of the Free State, the Bushveld areas of the Transvaal and the Marico district of the Highveld Regions. The parasite is commonly found in northern Natal, as well as in kwaZulu.

F. EXTERNAL PARASITES

As in the previous year, ticks took a heavy toll through diseases transmitted by them, abscesses and tick toxicosis. The tick problem has diminished in kwaZulu, because the recommended dipping programme was more conscientiously adhered to than in the previous year.

Boophilus spp. (blue tick) was very active in the Highveld, Free State and Natal Regions.

Rhipicephalus appendiculatus (brown ear tick) created severe problems in the wetter parts of the Northern and Eastern Transvaal Region, as well as in the Transvaal and Highveld Regions. The parasite was particularly troublesome in Venda and Gazankulu.

R. evertsi (redlegged tick) was very prevalent in the Natal and Free State Regions. Immature stages in the ears of nearly all animals cause retarded growth as a result of otitis externa and ophthalmia.

Hyalomma spp. (bontlegged tick) was also a problem in the Free State (especially in the

Kuruman and Vryburg districts), Natal and Highveld Regions.

Amblyomma spp. (bont tick) became established on one farm at Jan Kempdorp, but was apparently not infected with heartwater. This species was very active in Natal.

Paralysis caused by *Ixodes rubicundus* (Karoo paralysis tick) was a problem in the Western Cape (even calves affected) and Eastern Cape and Karoo Regions (springbuck also affected), as well as in the Southern Free State and the Randjiesveld of the Free State Region.

Sheep lice, particularly *Damalinia ovis*, were very prevalent in all the Regions (except the Natal and Northern and Eastern Transvaal Regions) and were particularly active in the Calvinia State veterinary area.

In kwaZulu *cattle lice* were a problem, particularly in the winter; these parasites were also widely encountered in the Highveld Region. Farmers failed to control the parasites efficiently. Cattle lice also proved troublesome in the Free State Region during the winter.

Keds *Melophagus ovinus* were very prevalent in the Highveld Region (but not in the Kroonstad State veterinary area) and the Eastern Cape and Karoo Region (also encountered in springbuck).

The incidence of *Psorergates ovis* (Australian itch mite) is on the increase in the Western Cape Region and the parasite is also common in the Eastern Cape and Karoo Region and kwaZulu.

Goat ear mange caused by a *Psoroptes* spp. was fairly prevalent in the Western Cape Region and has spread from the Namaqualand district to neighbouring districts.

Blowfly strike became prevalent in the Ixopo State veterinary area as a result of good rains, and cases of the infestations also occurred in the Eastern Cape and Karoo Region. In the Western Cape Region infestation was general and in the Riversdale district it has been determined that blowflies had become resistant to practically all the available pesticides.

Mosquitoes were not as troublesome as during the past few years. Midges followed the same pattern as mosquitoes. Dogs in Lebowa are commonly infected with *Demodex canis*.

Living *Hypoderma bovis* larvae were found in an imported cow, during a follow-up inspection, despite the fact that the animal had been treated twice against possible infestation while kept at a quarantine station. Subsequent treatment was effective, but this case underlines the importance of follow-up inspections of imported cattle.

G. ARTIFICIAL INSEMINATION

Two private AI Centres, one at Standerton and the other at Ogies, were approved and registered during the year.

The testing of bulls at the AI centres in Natal and the Western Cape was carried out at the regional veterinary laboratories at Allerton (Natal) and Stellenbosch (Western Cape). All other AI

bulls were tested, as in the past, by the Section for AI and Reproduction of the Division of Veterinary Services, in conjunction with the Veterinary Research Institute. The final recommendation on the registration or re-registration of AI bulls rests with the Section after all the results of the tests have been analysed. During the year under review 215 bulls were tested for this purpose.

One of the bulls reacted positively to tests for *Campylobacter fetus* and was therefore not registered as an AI bull. Testing revealed sperm abnormalities in excess of 20 per cent in 6 bulls. The semen of two of these animals had improved to such an extent by the end of the year under review that they were registered but the others were not registered.

At present, there are 43 AI bulls for which progeny testing has been completed. Thirty-one of these are dairy breed bulls.

The total number of doses of semen sold by AI centres during 1977 was 529 874 (644 222 in 1976). Of these, 378 088 doses were from dairy breed bulls and 151 786 from other bulls. AI centres collected 79 695 doses of semen from 232 private bulls on behalf of their owners.

A total of 17 015 doses of bull semen and 72 doses of pig semen were imported during the year under review.

H. STOCK INSPECTION SERVICES

The shortage of stock inspectors is increasing and 117 (17,9%) of the 655 posts for stock inspectors were vacant at the end of the year under review. Seventy new appointments were made during the year, but there were 91 resignations during the same period. There is virtually no core of experienced stock inspectors left and the younger men come and go, chiefly because of inadequate salaries. Heavier and heavier demands are being made on the stock inspectorate staff as the schemes for the eradication of bovine tuberculosis and brucellosis progress. The situation is undoubtedly a cause for concern.

I. ANIMAL HEALTH EXTENSION SERVICE

The volume and effectiveness of extension services rendered to farmers by officers of the

Division of Veterinary Services are continuing to increase. In addition to the Division's contribution to the training of prospective farmers at agricultural colleges and the compilation of leaflets and so forth, the following extension tasks are undertaken:

Farmers' days are arranged and addressed, articles are published in local papers and agricultural journals, farmers' unions and study groups are addressed, radio talks are compiled, short courses on stock diseases (prevention and control) are offered and programmes for vaccination and dosing are drawn up.

Farmers are given information and advice by State veterinarians and stock inspectorate staff on individual farming and veterinary problems, improved farming practices and the advantages to be gained by joining schemes, such as the bovine tuberculosis and brucellosis eradication schemes. Such information is imparted during visits to farms, office interviews, by telephone or by letter.

J. IMPORT AND EXPORT CONTROL

Import Control

As a precaution against the introduction of stock diseases from other countries, the Division has quarantine stations at Jan Smuts Airport, Durban, Cape Town and Walvis Bay.

Animals of many different types were imported for slaughter or other purposes.

	From neighbouring territories	From overseas
Cattle	4 749	7
Horses	156	48
Sheep	785	53
Goats	405	-
Pigs	553	-
Dogs	411	856
Cats	291	267
Poultry	100	21 820
Birds	1 600	28 872
Game	515	28
Reptiles	74	11
Rodents	3	432

Three birds were brought in illegally at Jan Smuts Airport. The quarantine master of the

AI Training

Courses offered by	Registerable inseminators		Owner inseminators		Labourers	
	Courses	Candidates passed	Courses	Candidates passed	Courses	Candidates passed
AI and Reproduction Section	4	55	5	80	-	-
SV Potchefstroom	3	44	12 (Cattle)	187		
			2 (Sheep)	26		
SV Bloemfontein			2	44		
SV Stellenbosch			6	73		
SV Mossel Bay			1	14		
SV Pietermaritzburg			2	20		
SAAU (Officers of the Division render assistance)					7	45
Training centre at Boskop						
Total	7	99	30	444	7	45

STOCK CENSUS

Region or Black state	Cattle	Sheep		Goats	Horses	Donkeys and mules	Pigs	Fowls	Dogs
		Woolled	Non-woolled						
Western Cape	396 160	3 146 173	1 472 292	447 655	17 843	9 253	253 184	7 091 134	43 046
Eastern Cape and Karoo	993 646	7 375 412	1 527 979	1 336 360	29 792	9 879	79 712	2 670 344	70 643
Transvaal	2 235 862	2 572 837	274 030	85 938	37 318	7 732	256 332	8 744 614	401 226
Natal	1 543 476	984 347	101 628	136 345	26 636	4 008	150 107	3 689 027	92 780
Free State	1 763 705	2 960 516	5 003 035	501 353	41 388	12 333	100 840	1 052 232	65 903
Highveld	2 118 962	2 540 916	375 639	51 346	56 711	3 862	220 478	3 128 430	133 077
Northern and Eastern Transvaal	1 200 719	232 914	142 251	115 076	6 785	13 066	80 113	1 146 442	53 711
TOTAL	10 252 530	19 813 115	8 896 854	2 674 073	216 473	60 133	1 140 766	27 522 223	860 386
Venda	138 759	-	2 539	44 316	14	7 158	11 685	45 672	15 727
Gazankulu	162 897	-	3 208	61 301	5	5 655	12 489	171 274	18 904
Lebowa	489 028	246	86 386	387 969	180	29 097	24 865	352 241	34 464
kwaZulu	1 424 690	57 577	104 702	536 197	44 702	Not divided	29 829	962 883	98 565
Qwaqwa	13 158	Not divided	2 254	11 560	547	64	104	50 844	867
Ciskei	186 980	224 737	Not divided	190 104	5 707	591	15 662	144 785	16 280
TOTAL	2 415 114	282 560	199 089	1 231 447	51 155	42 565	94 634	1 727 699	184 807
GRAND TOTAL	12 667 644	20 095 675	9 095 943	3 905 520	267 628	102 698	1 235 400	29 249 922	1 045 193

Division impounded them and they were subsequently destroyed.

Numerous different products were imported in accordance with permits issued by the Division. Attempts were made to import the following products through Jan Smuts Airport without the necessary permits: 164 eggs, 16 kg of fresh meat, 387 kg of other foodstuffs, 3 untreated hides and one unprocessed trophy. These were all confiscated and burnt.

Export control

For export purposes, veterinary examinations were carried out and certificates issued by officers of the Division of Veterinary Services, in accordance with the requirements of importing countries, in respect of the following animals:

	To neighbouring territories	To overseas countries
Cattle	39 897	-
Equines	760	11
Sheep	121	28
Goats	32	-
Pigs	1 152	-
Dogs	1 060	1 404
Cats	174	247
Poultry	290 273	570 047
Birds	295	145 312
Rabbits	11	-
Game	1	53
Reptiles	-	357
Marine animals and birds	-	118

Certificates were also issued by officers of the Division for a large variety of products intended for export.

K. TRAINING

State veterinarians of the Division again gave lectures on veterinary science at all the agricultural colleges. A standardised set of lectures for the use of all the colleges was drawn up in the final form and made available in both official languages.

The in-service training of members of the stock inspectorate staff was continued. Because of the foot-and-mouth outbreaks and financial considerations, only one course for 29 officials was held during the year. Since September 1972 525 officers have been trained in this way. Both the Division and the farmers are reaping the benefits, since these officers are now able to provide a better standard of service.

The in-service training of members of the stock inspectorate staff in the performance of tuberculin tests in terms of the bovine tuberculosis eradication scheme was continued when 24 officers attended a course. The 88 trained officers play an important part in the growth of this Scheme.

L. LEGISLATION

During the year under review the following Government notices were published in accordance

with the *Animal Diseases and Parasites Act, 1956 (Act 13 of 1956)*:

Government notice R.1705 of 2 September 1977:

Amendment of Regulations

Government notice 734 of 21 October 1977 -

Amendment of G.N. 484 of 12 July 1974

Government Notice R.2152 of 21 October 1977 -

Correction of typing error in G.N. R.1705 of 2 September 1977.

M. TECHNICAL RELATIONS WITH OTHER COUNTRIES

Liaison and co-operation with African countries

Visits were paid to the Head Office of the Division by scientists from Rhodesia, Botswana, Swaziland, Transkei and Bophuthatswana.

Liaison with overseas countries

Scientists from Spain, Oman, Israel, the United Kingdom, New Zealand and the USA paid official visits to the Head Office of the Division during the year.

The veterinary laboratory at Skukuza was visited by 12 overseas scientists and the regional veterinary laboratory at Stellenbosch received 11 visiting scientists. The visitors came from Australia, Canada, Holland, West Germany, the United Kingdom, Belgium, the USA, Spain, Italy, Switzerland and New Zealand.

N. CLINICAL SERVICES

State veterinarians continued to render veterinary services to all State-owned herds and flocks, and to provide clinical services for farmers whenever their official duties permitted, especially in areas where there were no private veterinary practitioners.

During the year State veterinarians received R23 960 for professional services and R11 743 for travelling expenses. Vaccines to the value of R2 568 were sold by State veterinary offices. Fees for laboratory investigations amounted to R19 727 and those for services rendered at export abattoirs to R383 336. Fees for keeping animals and birds in quarantine amounted to R40 978, and sundry revenue to R3 141.

The Division received R367 381 for the carcasses of animals slaughtered and approved for human consumption in accordance with the bovine tuberculosis eradication scheme. The grand total of revenue received by the Division of Veterinary Services amounted to R852 835.

DIAGNOSTIC SERVICES

Apart from the diagnostic services rendered by the State veterinarians in their own areas, the Division has four regional veterinary laboratories,

Distribution of cattle		
Region or Black state	White owners	Non-White owners
Western Cape	389 857	6 303
Eastern Cape and Karoo	950 242	43 404
Transvaal	2 052 262	183 600
Natal	1 265 322	278 154
Free State	1 734 968	28 737
Highveld	2 015 176	103 786
Northern and Eastern Transvaal	1 102 251	98 468
Total	9 510 078	742 452
Venda	-	138 759
Gazankulu	-	162 897
Lebowa	398	488 630
kwaZulu	-	142 690
Qwaqwa	-	13 158
Ciskei	-	186 980
Total	398	2 415 114
Grand Total	9 510 476	3 157 566

at Allerton, Middelburg (Cape), Stellenbosch and Windhoek, as well as smaller veterinary laboratories at Grahamstown, Queenstown, Kroonstad and Potchefstroom. An additional laboratory at Skukuza enables the Division to keep its finger on the pulse of animal health in the Kruger National Park. Furthermore, the AI and Reproduction and Poultry Diagnostic and Extension Services Sections of the Division at Onderstepoort offer a more comprehensive service to cattle and poultry farmers.

In addition to assisting State and private veterinarians, these laboratories play an increasingly important part in extension. This extension is mostly based on the latest local findings and is consequently acceptable to the local farmers. There is an increasing demand, at farmers' days, meetings etc. for lectures by officers from these laboratories.

There was an increase of 31,2 per cent in the diagnostic services rendered by the Division, as the following table shows:

	1976/77	1977/78
<i>Brucella</i> Rose Bengal tests	58 766	131 702
<i>Brucella</i> complement fixation tests	8 397	13 737
<i>Brucella</i> tube agglutination tests	63 761	58 930
<i>Brucella</i> milk ring tests	-	1 523
<i>Brucella</i> rivanol tests	-	379
<i>Brucella</i> mercapto-ethanol tests	-	367
FA tests	1 038	1 554
PPLO tests	17 153	24 084
BWD tests	818	786
HI tests	8 371	8 644
Gumboro serological tests	-	1 787
Adenovirus serological tests	-	877
Poultry <i>Mycoplasma</i> isolations	-	419
Bovine <i>Mycoplasma</i> isolations	-	157
Vibriosis	1 049	1 070
Trichomoniasis	493	1 396
Johne's disease	12	10
Leptospirosis	522	679
<i>Actinobacillus seminis</i>	47 271	33 448
Pasteurellosis	831	1 622

	1976/77	1977/78
Chlamydiosis	669	425
<i>Chlamydia</i> isolations	110	436
Antibiograms	802	1 540
Serotyping of cultures	93	290
Skin scrapings	876	344
Faeces examinations	20 051	16 541
Larval cultures	-	20
Identification of internal parasites	737	1 245
Identification of external parasites	34	505
Identification of plants	-	75
Mastitis milk examinations	4 894	15 613
Semen	10 372	7 706
Sheath washings	1 156	1 600
Vaginal swabs	1 351	1 183
Placentas	-	89
Aborted fetuses	344	488
Haematology	1 722	2 685
Biochemical	48 022	40 915
Toxicology	490	1 547
Dipping samples tested	-	182
Protozoological	-	94
Bacteriological	15 855	16 108
Virological	2 955	5 652
Biological	2 057	816
Histopathological	1 310	2 772
Abattoir by-products tested	18	1 014
Abattoir bacterial counts	-	19 176
<i>Trichinella</i>	34	310
Smears	22 549	21 930
Clinical examinations	33 625	20 159
Post mortem examinations (poultry excluded)	4 639	12 606
Post mortem examinations (poultry)	3 662	14 085
Poultry samples examined	3 968	21 649
Total	390 877	512 773

MEAT HYGIENE

ADMINISTRATION

Abattoirs

A total of 1 130 abattoirs in the Republic at present possess valid certificates of approval issued by the Division of Veterinary Services. Two hundred and fifty of these abattoirs are in the Black States. Red meat abattoirs number 850, and there are 266 poultry and 14 rabbit abattoirs.

Abattoirs are graded as follows:

Grade A - 101 cattle units or more per day

Grade B - 11-100 cattle units per day

Grade C - up to 10 cattle units per day

Grade D - two cattle units per day, with a maximum of 5 per week

(The above is applicable to red meat abattoirs)

Grade E - poultry abattoirs - 50 fowls or more per week

Grade K - rabbit abattoirs

Distribution of abattoirs with valid certificates of approval:

During the year the following 53 red meat abattoirs and 7 rabbit abattoirs were closed for various reasons and had their certificates for approval withdrawn:

Region or Black state	A	B	C	D	E	K
Transvaal	11	12	37	28	57	5
Northern and Eastern						
Transvaal	2	10	28	45	8	1
Highveld	4	9	32	19	41	-
Free State	2	4	33	43	29	-
Natal	4	8	24	25	55	5
Eastern Cape and						
Karoo	2	9	40	39	36	2
Western Cape	3	10	63	54	40	1
kwaZulu	-	-	-	69	-	-
Lebowa	-	-	11	107	-	-
Venda	-	-	-	38	-	-
Gazankulu	-	-	-	25	-	-
Total	28	62	268	492	266	14

Province/Black states	Red meat	Rabbit
Transvaal	7	4
Free State	6	-
Natal	6	-
Cape	5	3
Black states	29	-

No poultry abattoirs were closed during the year.

Certificates of approval were issued to 19 red meat abattoirs and 57 poultry abattoirs for the first time. The distribution was as follows:

Region/Black state	C	D	E
Transvaal	-	3	11
Northern and Eastern Transvaal	1	-	1
Highveld	-	1	10
Free State	-	-	2
Natal	-	-	10
Eastern Cape and Karoo	-	2	21
Western Cape	-	-	2
kwaZulu	-	4	-
Lebowa	-	8	-
Total	1	18	57

In accordance with the provisions of section 20(1) of Act 87 of 1967, subsidies amounting to R324 553 were paid to 43 local authorities on the salaries of 156 meat inspectors in their employ. The payment of such subsidies was suspended on 1 April 1978 by ministerial direction.

Sterilisation plants

At present there are 85 registered sterilisation plants in the Republic, 16 of which are new plants which were registered during the year.

These plants produce fish meal, carcase meal, blood meal, bone meal, fish oil and tallow and are inspected at least once a year by State veterinarians for the purposes of either registration or re-registration.

In addition, monthly sampling of products for bacterial inspection takes place at the abattoirs for which the Division provides meat inspection services.

Planning

In accordance with the provisions of Section 18 of Act 87 of 1967, the Division of Veterinary

Services examined 259 sets of plans for the erection, improvement and extension of abattoirs and factories for comment and recommendations.

The distribution of the plans was as follows:

Red meat abattoirs	161
Poultry abattoirs	76
Rabbit abattoirs	7
Game abattoirs	9
By-product plants	6

Meat imports

South Africa is still importing low-grade industrial meat from Rhodesia and Botswana. The local shortage of this type of meat was less than during the previous year.

Meat exports

The following quantities of meat were exported during the year:

	Overseas	Neighbouring countries
Frozen, refrigerated and canned red meat	207 922 tons	2 644 tons
Meat products	30 tons	1 ton
Poultry	6 164 tons	-
Game	930 tons	-

Legislation

The following Government notice was published during the year under the *Animal Slaughter, Meat and Animal Products Hygiene Act, 1967* (Act 87 of 1967):

Government Notice 898 of 23 December 1977 -

"Granting of exemptions to certain abattoir owners, operators or persons".

MEAT INSPECTION SERVICES

Departmental

The Division is responsible for meat inspection services at abattoirs belonging to or managed by the Abattoir Corporation, as well as at privately owned abattoirs approved as export establishments.

Under the control of the Division considerable progress has been made with raising the standard of hygiene at all abattoirs. Owners are encouraged to improve the standard of hygiene voluntarily. Legal action was taken only in cases where improvements that could have been effected through better management or at minimal cost had not been implemented. Where the cost of repairing structural defects would be very high, exemption is granted provided that the owner applies for it.

The number of abattoirs to which exemption was granted, in the various Regions, is as follows: Transvaal 10, Northern and Eastern Transvaal 4, Highveld 3, Free State 3, Natal 13, Eastern Cape and Karoo 10 and Western Cape 20.

In terms of a ministerial decision, exemption will in future be granted only in exceptional cases.

GRAZING UTILISATION RESEARCH

NATURAL GRAZING

In contrast to the good seasons of the past few years, conditions during the year under review were less favourable. Many areas registered high rainfall figures, but the distribution was poor and the western parts of the Karoo and the winter rainfall area suffered severe drought.

Bushveld areas

Research on the chemical control of invader bushes is still receiving high priority, since bush encroachment is considered one of the biggest single obstacles in the way of sustained and increased red meat production in the bushveld areas. The grazing research programme in the SWA Region centres around this problem.

On the basis of research undertaken since 1974, Tordon 225 has been registered for the aerial spraying of invader bushes and is already being commercially applied on a fairly extensive scale in the RSA and in SWA. Since the costs remain high - although it is still the cheapest form of bush control to date - all spraying carried out in the Region each year is used to obtain additional data on a basis of co-operative trial work in order to refine the effective doses, increase the efficacy of the spray and monitor all factors that could possibly affect spraying. The overall aim is to increase the efficiency and reduce the cost of spraying. It has already been possible to reduce the volume of spray from 40 l/ha to 20 l/ha and work on ultra-low volume applications is still considered promising and is receiving attention. It was also possible to reduce the diesel in the spraying mixture from 10 l/ha to 4 l/ha and to find a cheaper wetting agent; the environmental factors that affect spraying have been more clearly defined and effective spraying has been carried out with doses as low as 1 l/ha of Tordon 225. Good progress has already been made with the replacement of 2,4,5-T in the Tordon compound by a cheaper and more effective agent. This work was prompted chiefly by the consideration that 2,4,5-T may go off the market.

Trials on the manual application of Tordon 225 were started during the past year. Doses as low as 1,0 ml per bush can already be applied and if registration can be obtained for the manual application of Tordon 225, this method of application should fulfil an important function in areas where small local bush problems are experienced or where hedges and roads have to be kept neat. At present it promises to be the cheapest and most effective method of manual application that could be used.

Depending on the degree of bush encroachment, preliminary results indicate that an improvement in animal production varying from 20% to 200% can be obtained as a response to bush control.

A trial was carried out at the Armoedsvlakte Research Station in order to evaluate the production potential of young limestone veld. Young, growing cattle were grazed at various stocking rates. The results of the trial for the year under review are summarised in the following table:

TABLE - Animal production and aerial biomass production at various stocking rates at the Armoedsvlakte Research Station

Stocking rate (ha/livestock unit)	5,9	4,3	3,8	2,5
Mass increase (kg/day)	0,5	0,48	0,49	0,47
Live mass production (kg/ha)	25,5	32,9	40,6	56,7
Aerial biomass in April (kg/ha)	1 542	1 500	1 368	1 292

The slight difference in the average daily mass increase between the treatments and the high live mass production per ha in the case of the higher stocking rate are a direct consequence of the good rainfall - 685 mm where the long-term average is 475 mm.

During the first season in which the trial was in progress the cattle performed slightly better with continuous grazing than with rotational grazing. The average mass increases with the various stocking rates were 0,5 kg/day with continuous grazing and 0,48 kg/day with rotational grazing. The average live mass production per ha was consequently also slightly higher with continuous grazing (39,2 kg) than with rotational grazing (38,6 kg). However, it was evident even at this early stage that the aerial biomass production of the highly desirable grass species declines with continuous grazing.

Karoo and Winter Rainfall Regions

Good progress is being made in the Karoo Region with the collection of data for determining the effective available biomass and production of the most important plant species in eleven different veld types. At present 111 species are involved in this investigation and these species constitute the most important components of the various veld types in the Karoo. Climatological data and grazing records for the camps in which the plots are situated are being collected by the collaborators. Habitat data on each plot have been intensively described and soil samples are being subjected to chemical and mechanical analysis. It is intended to use this information to draw up production curves for the various species found under different habitat conditions in the Karoo.

Existing production and biomass figures for Karoo plants and climatological data were processed and used for the drawing up of production functions. These functions were used to develop a prototype pasture productivity model. The model is capable of simulating production and biomass changes on a weekly basis. Further refinement of the model is necessary, however, and

will be carried out when the planned production trials are started on a part of Grootfontein at the beginning of the new growing season.

A study of voluntary intake, digestibility and chemical composition of Karoo veld as selected by small and large stock is being undertaken at present. The percentage of digestible organic matter shows a clear seasonal trend. The same trend was not observed, however, in the crude protein and phosphorus percentages. The crude protein percentage in samples selected by small stock was higher throughout than that in samples selected by cattle.

At the Upington Karakul Research Station an evaluation of the nutritional value of Orange River broken veld and soft-veld during the winter and early summer months showed that these two veld types meet the nutritional requirements of dry sheep except during the months of August and September in the soft-veld. Preliminary results show that the broken veld provides better grazing than the soft-veld in respect of crude protein and organic matter. The difference between the two veld types may be ascribed chiefly to their botanical composition, since the broken veld contains a shrub component. Wheel point surveys are being carried out at present in order to determine the botanical compositions accurately.

Research shows that the valley bushveld of the Eastern Cape contains an accumulated quantity of material of which only a small percentage is actually available to the ruminant. Long rest periods can be useful in raising the production potential of valley bushveld, particularly in the case of damaged veld. The length of a rest period does not have a notable effect on the quality of valley bushveld. In practice the farmer can therefore apply a long rest, in an attempt to improve the quantity of the grazing, without sacrificing quality. Results indicate that a 50 per cent defoliation of shrubs is useful in boosting production per shrub. An autumn-to-autumn rest period is extremely effective in raising feed production from shrubs, but a winter-to-winter rest period has few advantages. Results indicate that any utilisation programme in the valley bushveld can be built around long rest periods. Research clearly shows that in the valley bushveld, quantity, i.e. the amount of feed available, and not quality, is the limiting factor in the production process.

The effect of seasonal defoliation and the degree of defoliation on the reserves and dry matter production of shrubs and grass was investigated in the Winter Rainfall Region.

Results showed that light pruning has relatively little effect on the root mass of either *Ehrharta calysina* or *Osteospermum sinuatum*, but severe pruning does result in a clear decrease in the root mass. It was also apparent that, under favourable conditions, the growth period of pruned plants was longer than that of the control plants. The result is that the total dry matter production of lightly pruned plants exceeded that of the control plants during the experimental period.

Central grassveld areas

The nutritional value of natural grazing and the effect of supplementary feeding are being critically examined in the OFS Region. Very illuminating results have already been obtained.

The effect of protein and phosphorus supplementation on Dorper and Merino wethers was investigated in a comprehensive trial. The advantages attached to both supplements should be reflected in better production and reproduction. The main object of providing protein supplementation for sheep is to -

effectively change the selective grazing habit of the animal, and

increase the feed intake of the grazer.

An investigation at Glen showed that the grazing habit of neither the Dorsers nor the Merinos can be changed in this way. It was also found that the provision of protein supplementation (fishmeal) in the form of a lick consisting of 50 % fishmeal, 30 % salt, 15 % dicalcium phosphate and 5 % Calorie 3 000 cannot increase the feed intake of sheep on veld grazing. However, where the protein supplementation is administered directly into the rumen an increase in feed intake is obtained during the winter months. This raises doubts about the efficacy of protein supplementation in the form of a lick.

The effect of phosphorus supplementation on the production and reproduction of Merino ewes and their lambs is being studied at Glen. A similar investigation with Dorper ewes is in progress at the Koopmansfontein Research Station. The part played by phosphorus supplementation administered in the form of a lick throughout the entire reproductive life of the ewes is being studied. This study has been in progress since 1973 and no indication that phosphorus supplementation has been beneficial has been obtained so far. The phosphorus intake of the ewes from the lick was disappointingly low and for this reason the phosphorus requirements of some of the Merino ewes are now being placed directly in the rumen every day. Results are not yet available.

The determination of the dry matter production of natural grazing by standard objective methods is generally labour-intensive and time-consuming. The disk pasture meter was developed as a rapid non-destructive method, but only gives acceptable results on fairly homogeneous pastures with a relatively even crown height. Grassveld in the low rainfall areas has a characteristic variety of physiognomy and the disk meter readings have a low accuracy in these veld types. A technique study has been in progress at the Glen College of Agriculture during the past growing season with the aim of adapting the disk meter to the natural pastures typical of the Central Grassveld. It was found that if the disk is replaced by a base plate and readings are taken in four quadrants around each sampling point, a very good regression of average height on yield can be obtained. This development holds out the

possibility of a rapid and reliable technique that can be used with various veld types. The technique will have to undergo further development to determine the effect of the stage of growth and moisture content of the pasture on the calibration of the apparatus.

Very good results were obtained in the Highveld Region with the application of controlled selective grazing. *Digitaria* species increased to such an extent that they can be described as dominant in some camps.

Even after an accidental fire this veld recovered remarkably well because no grazing was permitted before the grasses had reached a stage safe for grazing.

Radical veld improvement is still high on the research priority list in the Highveld Region. The overseeding of grasses such as *Cenchrus ciliaris*, *Digitaria smutsii* and even *Eragrostis curvula* in veld without any physical disturbance of the surface of the soil was abandoned after two attempts over two seasons, since the overseeded grasses did not establish at all. In another trial, where a tine implement was used to break the soil in a criss-cross pattern before *Digitaria smutsii* and lucerne were overseeded, excellent establishment of both crops was obtained.

Where the veld was overseeded with *Digitaria smutsii* and lucerne together, good mass increases were still being obtained after four seasons of utilisation by young steers. Despite the fact that the lucerne grows faster in spring than *D. smutsii*, no cases of bloat have occurred so far. The reason may be that, because of the high palatability of the grass component, the animals do not take in excessive quantities of lucerne.

In an investigation into nitrogen fertilising of the veld, a single application of nitrogen in August was compared with three applications spread over the growing season. It appeared that the former procedure was far more economic. For instance, a single application of 160 kg of N/ha produced the same hay yield as the triple application of 80 kg of N/ha (240 kg of N). The single application therefore reduced fertiliser costs per ton of hay by a third.

High-potential areas

Although the research programme in these areas is concerned mainly with artificial pastures, natural veld is also studied.

Four variations of a four-camp rotational grazing system were evaluated at the Kokstad Research Station over a period of eight years. Multiple light defoliations impaired the growth vigour of the veld and it was necessary to withdraw the veld from grazing for 40 to 50 days to allow it to recover. Grazing periods should be relatively short, namely four to eight days. Multicamp systems with high stocking rates led to a more uniform utilisation and less selection.

The technique of assessing veld conditions developed by the Department of Pasture Science of

the University of Natal was successfully applied in grazing trials and is being applied on farms by the Natal Region at present.

ARTIFICIAL PASTURES

Legumes

The sharp rise in the price of nitrogen fertiliser since 1973 has led to renewed interest in legumes as a source of nitrogen in agriculture. The year under review was distinguished by specific programmes aimed at disseminating information by means of farmers' days and short courses and expanding research projects on legumes.

Particular attention was given to the introduction and evaluation of legumes in the summer rainfall areas for which suitable pasture legumes have not yet been identified. Almost 100 legume species consisting of 300 cultivars are being evaluated in nursery studies at Rietondale at present for possible further use. Attempts are also being made to solve the modulation problems that may arise with specific species or under specific soil conditions.

The use of annual cold weather legumes is seen as a possible solution to the difficult winter grazing conditions in the summer rainfall areas. Preliminary observations at Rietondale have already shown that these crops are well able to utilise autumn rains and are capable of providing good grazing far into the winter. On the basis of these observations, a yield trial with common serradella *Ornithopus sativus*, yellow serradella *O. compressus*, *Lathyrus sativus* and *Lupinus consentinii* was laid out on poor, acid sandy soil in the Waterberg area. Soil that is inclined to get very wet in summer and remain damp in winter was selected for this purpose. At this stage the serradella is doing very well and there appears to be considerable potential for it in the area concerned, since large areas of the "wet" soils occur there. These soils are considered unsuitable for field crops during most years; it is therefore possible that serradella could convert them into a considerable asset. Owing to the undoubted potential of serradella in summer rainfall areas with very poor soil, the multiplication of yellow serradella *O. compressus*, which has hard-coated seed and should therefore be better able to survive than common serradella, which has a low percentage of hard-coated seed, was started.

In view of the potential of serradella in some summer rainfall areas, the investigation of inoculation methods to ensure long survival of rhizobia on inoculated seed was started. This is considered essential, since conditions for germination are not always favourable. In a field trial at Rietondale soaking the seed in a suspension of rhizobia, followed by ordinary inoculation with peat inoculant, produced the best nodule formation.

According to a related laboratory experiment, this method of inoculation ensured the best survival of rhizobia. Seed inoculated in this way and stored

at 30 °C contained satisfactory numbers of rhizobia even after 117 days. This investigation gave rise to the conclusion that the fruit-wall that covers the serradella seed probably helps the rhizobium bacteria to survive.

Preliminary trials at the Nooitgedacht Research Station showed that the traditional winter rainfall crops such as annual medics and subterranean clovers are also promising sources of autumn and winter grazing for sheep in the summer rainfall areas. On these small plots some of the clovers produced up to eight tons of dry matter per ha, available chiefly from March to June. On the other hand, legumes from the medics are available chiefly from June to August.

In a rotational cropping trial carried out in the Winter Rainfall Region, mixed grass/legume pastures were replaced by wheat, oats and barley, without a fallow period. The general assumption that wheat that follows pastures directly is necessarily subject to diseases such as *Ophiobolus* and *Rhizoctonia* was strongly contradicted. Yields of 22,8, 53,0 and 41,4 bags of grain per ha were maintained for wheat, oats and barley, without the application of nitrogen fertilising.

A yield of up to 11 m tons per ha was obtained at the Tygerhoek Experimental Farm from subterranean clover cv. Clare and legume yields of up to 5 m tons/ha were obtained from the annual medic cv. Ghor.

The tropical legume *Desmodium intortum* (greenleaf desmodium) did very well in a grazing trial in the coastal area of the Eastern Cape Region. The crop grows fairly well on relatively sour soils and does not cause bloat. Provided it is not too heavily grazed during the growing season, it presents few management problems. During the year under review a carrying capacity of three steers per ha was maintained and the calculated meat production was 374 kg per ha.

Cenchrus ciliaris

In a trial at Vaalharts with Dorpers run on *Cenchrus ciliaris* under irrigation it was found that the green cenchrus grazing complied with the nutritional requirements of the breeding ewes, but that the growth of the lambs on cenchrus hay was extremely poor. An economic analysis after three lambing seasons (eight months each) indicated that the gross income from meat and hides did not cover the production costs.

It was found at Glen that where buffel grass hay was fed to cattle and sheep, the voluntary intake by the two species was much the same per unit of body mass. This difference became strikingly great as the digestibility of the hay decreased.

The effect of N fertilising on the nutritional value of buffel grass in green chopped form was also investigated. The fertilising caused an increase of 19 and 10 per cent in the dry matter intake by sheep and cattle respectively. On the other hand, digestibility was virtually unaffected by fertilising.

Despite the economic problems attached to fertilising grass pastures, this system is still arousing interest and research will continue.

Eragrostis curvula

During the year under review considerable attention was given to a summary of existing information on the plant. A multiple regression model, capable of predicting the production potential of this grass in the eastern high rainfall areas of the country very accurately, was put together.

An investigation was also carried out to determine the effect of the fertilising level and harvesting stage on the yield and nutritional value of the hay. As soon as this has been completed, a model for animal production forecasts will become available.

In view of the problems experienced with hay-making, trials are being carried out with *Eragrostis* silage at present.

Digitaria smutsii

The evaluation programmes with *Digitaria smutsii* are proceeding. The grass has major possibilities as a summer grazing crop in the Highveld and produced high yields during the season, with the advantage of a relatively good production in autumn. It combines well with lucerne and it has been grazed by oxen for four years at Potchefstroom, where it was established in alternate rows, without either of the two components deteriorating.

Other crops

Crops such as rye-grass, kikuyu, *Antheophora pubescens*, star grass, Coastcross II and others are still being included in evaluation programmes.

During the year under review considerable attention was given to summarising existing information and making it available to the livestock industry in an acceptable form.

FORAGE CROPS

Lucerne

Very good lucerne seed tests were carried out during the past year, and it is expected that it will be possible to meet the local demand. As a result of droughts in the Winter Rainfall and Western Karoo areas, lucerne hay is difficult to obtain, however.

The development of acid-tolerant types is still receiving high priority in the Department's lucerne breeding programme and a number of the most promising types are being evaluated at present.

At Oudtshoorn, where lucerne hay production is determined at various levels of irrigation, there was a significant increase in the yield between the 135 mm and 180 mm irrigation levels and the increase in the yield was highly significant between the 90 and 180 mm levels. However, no differences in yield were obtained by administering half the

water at the beginning of the production period and the rest in the middle.

Winter cereals

The value of winter cereals and Italian rye-grass as reserve winter grazing was evaluated at Kokstad. Dry matter yields from most species reached their peak during August, but multiple defoliation during winter suppressed total production. In general the quality of the dry matter, expressed in terms of crude protein and crude fibre, remained unchanged until the beginning of August, after which it deteriorated. The quality of the matter harvested during September was better than that of the available hay and silage.

Small grain crops evaluated for winter grazing in the Eastern Cape Region made a good showing

despite a dry winter. Oats, which produced the best results, yielded about five tons of dry matter per ha.

Saltbush

The breeding programme for old man saltbush *Atriplex nummularia* is progressing well. Palatability to sheep remains one of the limiting factors in the utilisation of this crop. Only about 21 % of the original population was readily eaten during the first eight days of grazing. Careful selection has led to the development of a population with a sodium chloride content of between four and seven per cent, and 67 per cent of this population was eaten readily during the first eight days of grazing.

IV. Agricultural Resource Development

RESOURCE CLASSIFICATION

Six of the 70 land type maps (scale 1:250 000) have been printed and a further eight maps are ready to go to press. With the exception of the Pretoria map, these maps cover the OFS agricultural region and the western parts of the Highveld Region.

A further 23 maps have reached an advanced stage of preparation for publication and the field-work for another 11 maps has been completed. The reports (inventories) on the maps are still being prepared and will be published at a later date.

Peri-urban soil surveys of the Pretoria-Witwatersrand-Vereeniging (PWV) area, on a scale of 1:50 000, comprise 21 maps. The field-work for eight maps has been completed and that for another seven maps has reached an advanced stage.

The field-work for nine out of approximately 34 maps of the Cape Town-Saldanha-Montagu complex has been completed.

With regard to the surveys for irrigation development, a detailed study was made of 4 690 ha and a semi-detailed study of 847 000 ha.

In the Transvaal Region a comprehensive soil survey of 10 044 ha was carried out on behalf of the Department of Agricultural Credit and Land Tenure. This area includes 7 174 ha in the Magisterial District of Koster, where it is intended to use an evacuated "black spot" for subdivision into economic units and occupation by White farmers. In the Magisterial District of Piet Retief the soil survey for the Anys Spruit target area, which covers an area of 45 000 ha, was completed. Another 13 soil surveys were carried out where data were required for laying out new lands and there were indications that farmers were becoming more aware of the value of soil surveys in eliminating production differences.

Resource classification was continued in the Highveld Region, but a different approach was adopted. A Resource Classification Section was started under the professional aegis of the Soil Science Section. The task of this Section is the organisation of soil classification in the Region and the application of quality control in respect of the various teams made up from Extension field staff. This change in procedure has meant that the administrative work that used to be carried out by the field staff is now dealt with by the Resource Classification Section.

The original aim of resource classification was to classify at least one area in each extension ward. This aim has virtually been achieved and the volume of classification work dealt with by officers is expected to be reduced. Progress with classification in the Region is shown in Table 1.

In the course of the application of the Region's development programme about 270 000 ha of high-potential land was comprehensively classified to a scale of 1:20 000. This area consists of 22 areas distributed throughout the Region.

Report meetings were held in eight areas to discuss soils, that occur there and problems that had been identified. On these occasions each farmer was given his own soil map, together with a guide showing expected yields, management practices etc., and the maps were explained. Extension programmes aimed at applying these practices at the farm level have already been launched. The training of farmers in classifying their own soils will begin next year.

During the year under review maps for 123 land types were made available for the Free State Region. The production techniques and yield norms study can now be carried out on the basis of the most important land types. It will also be possible to continue demarcating relatively homogeneous farming areas. In the extensive stock farming area of Gordonia, for instance, 13 land types were identified which could be divided into four for the purposes of farming areas.

A soil series classification of the Bucklands irrigation area at Douglas was completed by the Soil and Irrigation Research Institute and the series classification of the land of collaborators in the production techniques and yield norms study was also partially completed.

Soil samples of the soils of collaborators are taken, mainly to determine plant nutrient status, effective depth and clay percentage. Although the importance of soil sampling for fertilising recommendations is stressed at meetings, farmers are reluctant to take samples. During 1977/78 95 soil samples were analysed and analytical results at Vaalharts indicate that soils show a serious potassium deficiency and have a very high phosphorus status.

In the Wepener extension ward a comprehensive soil series classification was carried out on a 398 ha farm. This classification revealed the complexity of the incidence of various soil series. Resource units of 5 to 10 ha, on the basis of series classification, were the rule rather than the exception. This classification confirmed the low

TABLE 1 - Progress with resource classification

Description	Year	Total
	1977/78	
Number of development areas identified	1	19
Groups of isolated farms identified	3	3
Total area of these areas (ha)	32 314	276 928
Number of farming units these areas comprise	54	564
Area of the areas stereoscopically analysed with the aid of contact aerial photographs (ha) (All variables that affect the soil type, e.g. slope, colour, etc. used as criteria)	32 314	276 928
Area of the areas checked in the field by means of a drilling programme in respect of soil boundaries, soil types, slope, degree and type of erosion, etc. (ha)	32 314	276 928
Area of the areas on which profile holes were dug and described on the various soils (ha)	32 314	276 928
Area of the areas for which contact aerial photographs have been finalised and corrections made (ha) (Classification in the field therefore complete)	32 314	276 928
Area land use maps with legends completed to a scale of 1:20 000	7	14

potential of the cultivated land. Over 60 % of the existing lands on the farm had a production index of under 25. Only 10 % had a value of over 80.

Because the Eastern Cape Region is aware of the importance of and the necessity for resource classification as the basis for and an aid to well-organised, optimum resource utilisation, this service received attention over a wider area during the year under review than in the past.

Activities in this connection may be summed up as follows:

In the coastal strip of the Komga and East London districts, where pineapples are grown, an intensive classification of soil and slopes was carried out on 6 000 ha to establish soil conservation standards for these conditions. It was found that certain soil series are not suitable for pineapple growing, whatever the slope, and that it is desirable to apply certain restrictions with regard to the slope on other soil series. These standards will be used for soil conservation guidelines for controlling the washaways that occur in pineapple fields; the guidelines will be finalised early next year.

In the Upper Orange Catchment, above the H.F. Verwoerd Dam, which is still considered a top priority area, surveys were completed in the Telemachus/Skulpspruit Subcatchment during the year under review. This subcatchment consists of 92 farms and has an area of 59 387 ha. This brings the total area investigated to about 560 000 ha.

Since 1970 the Region has had a special team of officers in the Upper Orange Catchment working exclusively on resource classification. To date intensive soil science, botanical, hydrographic and in some cases socio-economic investigations have been carried out in 11 subcatchments. The survey data were processed and broad guidelines drawn up for farming management in those areas. Farm plans in these subcatchments are based largely on survey data. However, for practical reasons, adjustments have to be made here and there.

During the year under review resource classification was also carried out in the smaller areas of the Region, e.g. soil classification was done in the Sundays River Valley. Considerable use is made of resource classification in the techniques for determining soil production classes when planning roads. Some officers also carry out a soil

classification to determine whether it is desirable to lay out a new land.

Over the past year the entire Eastern Cape Region was divided into fairly homogeneous farming areas and mapped. Standards for various branches of production in each area were linked to resources. The drawing office at Aliwal North is engaged in multiplying the maps and it is intended to make a guide on the utilisation of resources available to extension officers in the Region.

In the Stellenbosch extension ward of the Winter Rainfall Region 1 217 ha of detail classification was completed during the past year, which brings the total for this ward to 12 782 ha; production unit planning has also been carried out on half this area.

The soil classification map of the Hex River Valley (scale 1: 10 000) was also finalised during the past year. At Ceres the plant improvement farm Excelsior, which is 975 ha in extent, was classified (scale 1:2 500); this makes more logical planning possible, particularly with regard to drainage. The Tulbagh Basin and the entire Breede River Valley from Ceres to Drew Station were also classified into soil associations, to a scale of 1:50 000, with a view to irrigation development. This work is of considerable value for extension purposes as well.

Soil descriptions, based on profile holes, were done in several extension wards with a view to making recommendations on irrigation, fertilising and the establishment of crops. In the Stellenbosch ward 357 ha on 42 farms was described and at Wellington the figure was 687 ha on 53 farms. Large areas were also studied and described at Worcester, Ceres and Robertson and along the Riviersonderend. In the latter case 500 ha was classified and a use classification was drawn up for crops.

In the Swartland Subregion a comprehensive soil classification of the cropland of four members of the Malmesbury wheat study group was undertaken. The aim was to determine what part soil classification can play in wheat production under dryland conditions.

The demarcation of fairly homogeneous farming areas was completed in most of the extension wards where land type classifications are already available.

The Little Karoo Subregion was divided into 70 fairly homogeneous farming areas and demarcated on 1:25 000 topocadastral maps. A comprehensive description of eight areas has already been completed.

In the five extension wards of the Southern Cape Subregion 270 land types were demarcated into 52 fairly homogeneous farming areas. Descriptions of each of these areas were completed and priorities were identified in the various extension wards on the basis of a standard point scale applied in the Winter Rainfall Region.

In the Swartland Subregion 28 land types were grouped together in the Durbanville extension ward to form 5 fairly homogeneous farming areas; in Malmesbury 46 land types were demarcated into five fairly homogeneous areas and in Moorreesburg 34 land types were provisionally demarcated into five areas. The areas were entered on a map drawn to the scale of 1:250 000. Three of the fairly homogeneous areas have already been comprehensively described and considerable progress has been made with the description of the remainder.

By combining land types the various wards in the Boland subregion were classified into the following fairly homogeneous farming areas:

Ward	Landtypes (Number)	Fairly homogeneous farming areas
Wellington/Drakenstein	61	19
Stellenbosch	59	11
Worcester	25	13
Robertson	11	8

The Region aims to complete the task of combining the land types into fairly homogeneous areas and describing such areas by 31 July 1978. Progress in virtually all the extension wards has been very satisfactory.

The land use unit of the Natal Region is assisting the Soil and Irrigation Research Institute with the mapping of the Midlands and the mountainous areas, to a scale of 3½ x 50 000. Only eight of the 30 maps of Northern Natal remain to be completed. About half of the Drakensberg soil type map has been completed. The soil type map for the entire Region is expected to be completed by the end of 1980.

A very valuable soil report on the Kokstad and Cedarville areas was brought out at the beginning of 1978. The report contains soil maps, particulars of soil and other natural resources and identifies the most important agricultural sites. Intensive soil surveys were carried out on 11 properties and soils with an area of 2 470 ha were classified.

The Land Use Unit is responsible for demarcating homogeneous areas in Natal, and this task will be continued during the coming year, together with the determination of norms. The Regional Development Programme for the Natal Region is being revised at present.

During the past year the Town and Regional Planning Commission was assisted with the determination of the agricultural potential of soils around Richards Bay and Empangeni. Very close liaison was also maintained with regard to assistance and advice on water sources in Natal, in areas such as the Boesmans River Scheme, the St. Lucia Forest, the Umfolozi Flats, Frankenvlei, Greytown, Baynesfield, the Cedarville Flats and the Umlaas River.

The Unit also participated in numerous field inspections and investigations, including those required for the planning project at Nkweleni, and inspections and investigations at sites such as Jozini, the Drakensberg Catchment and the titanium mines' on the Zululand coast.

During the past year soil interpretation, which is one of the tasks of the Land Use Unit, was carried out for the Grazing Section, the Department of Water Affairs and the Roads Department. The unit proceeded with the drafting and preparation of a guide on "whole farm planning" for use by the extension staff.

AGRICULTURAL METEOROLOGY

The rationalisation of the subdivision's research projects under four key programmes was completed during the year under review.

The number of agricultural meteorological stations increased. New stations were built in the Fish River and Orange River Valleys and in the Highveld and Transvaal Regions. Historical data from all weather stations in the Eastern Cape Region were obtained from the Weather Bureau, coded and fed into the computer. The same process was followed with several stations in the Highveld and O.F.S. Regions. All evaporation data were obtained from the Department of Water Affairs, coded and fed into the computer. A technical communication giving the entry and exit dates of certain minimum temperatures for the entire Republic of South Africa was prepared.

Good progress was made with the mapping of heat units over 10 °C to a scale of 1:250 000. The moisture balance model for maize was tested at actual yields of P P x K 64 r and a good prediction formula was arrived at. This project gave rise to two publications during the past year.

The highlight of the year under review was the establishment of the data bank for agricultural meteorology. It was put into service after having been developed and tested by a member of the research staff of the subdivision. This data bank makes it possible to edit and load data from any terminal and carry out several types of processes, a rainfall analysis, and make data available for further processing in various forms, such as monthly and annual reports and disc files.

With regard to the effect of weather on crops, the cotton project was continued at Loskop, Vaalharts and Upington, and the study of

techniques for predicting picking ripeness of apples was also continued. In the case of maize it was found that the use of two-hourly temperatures instead of the daily maxima and minima dramatically improved the variation in heat units required from planting to flowering in S A4 maize. Research at Cedara on the absorption of radiation by a stand of maize threw new light on the modelling of leaf orientation. An illuminating article on this matter is in the process of publication.

The evaluation of artificial windbreaks at Bien Donn  was concluded and a publication was prepared and submitted. New projects were started during the year under review: The influence of windbreaks on vegetable production and the use of high palmetto systems as windbreaks were investigated. The wind survey in the citrus areas proceeded and the last season of the study on the influence of windbreaks on citrus production and quality in the Gamtoos Valley was completed. The study of the microclimate at the Theewaterskloof Dam was continued. Six years' data have now been collected prior to the filling of the dam.

IRRIGATION RESEARCH

The measurement of water consumption by Valencia oranges by means of weighing lysimeters is proceeding. These measurements make valuable contributions to the understanding of citrus/water relationships. Firstly, the seasonal pattern of water consumption previously determined was confirmed; this pattern is being analysed in order to determine the roles of climate, soil and tree physiology. This is a necessary step in the direction of the more accurate prediction of water consumption by citrus orchards. Lastly, water consumption data are used to evaluate the effects of irrigation frequency on tree physiology, salt in the root zone and water movement in the soil profile.

In a study directed at the mathematical description of the evapotranspiration of annual crops, accurate weighing lysimeters are being employed at Roodeplaatt to determine hourly evapotranspiration in soya-beans in summer and wheat in winter. Weather, plant and soil moisture conditions are measured simultaneously in order to calculate evapotranspiration estimates by means of provisional models. These estimates reveal any defects in the existing models when compared with the measured values. The models are then refined through further research.

Since 1972 and 1973, when overirrigation was often measured with commercial flood, sprinkler and microjet irrigation systems, attempts have been made to improve irrigation management through experimental work. As a result of four years' research on irrigation management an improved technique of irrigation management, capable of preventing both overirrigation and underirrigation, has been designed. The technique depends on the use of tensiometers to control quantities and

frequency of irrigation. The technique has been thoroughly tested on citrus, soya-beans and wheat.

A survey revealed that during 1974 and 1975 - years with above-average rainfall - there was about 3 000 ha of brackish soil on the 30 000 ha of the Vaalharts Government Water Scheme. The results of a recent investigation into the effect of brack problems on crop yields were used to calculate that the annual loss of gross income on the area of brackish soil mentioned above would be about R2 million (1977 prices). This is a further indication of the benefits that can be expected from the 300 new drainage systems installed between 1975 and 1978, particularly if seepage from dams and canals and excessive irrigation can be reduced.

The water:yield function defines the relation between water consumption and the yield from a crop. A study carried out during the past years revealed that this relation is useful in determining what the smallest quantity of water is with which the highest yield can be obtained. This is the case if water is the sole factor limiting the yield. On the other hand, the water:yield function may also be used to evaluate the efficiency of the irrigation management of any irrigation system. Water consumption and yield figures for wheat have been collected from 1960 onwards and various techniques for determining the yield functions of wheat for different areas will be applied. The next step is the evaluation of management and the planning of a number of irrigation systems for the areas concerned.

Dr. W.S. Meyer, a contract researcher from overseas, was appointed specifically to assist with basic research on the role of water in the soil-plant-atmosphere system. The Water Research Commission is financing his appointment.

OTHER SOIL AND WATER STUDIES

The Department analyses 16 977 soil samples and 10 494 plant samples annually in order to promote the efficient use of soil, water and fertilisers, keep the pollution of the resources of water and soil to the minimum, and correct nutrient deficiencies and imbalances as economically as possible. It was established that 27% of the soil samples analysed were low in potassium and 46% low in phosphorus.

The wide variety of determinations and analytical methods used for determining phosphorus can cause confusion among farmers and result in poor communication between different analytical services. It was therefore decided, on the basis of research, to adopt the ISFEI method as the standard method for reference and communication.

During 1977, 2 757 953 metric tons of fertiliser was used for agricultural crops. This included 343 845 tons of nitrogen, 170 321 tons of phosphorus and 112 509 tons of potassium.



Caterpillar tractor and special apparatus used for laying underground drainage pipes. This photo was taken at Vaalharts in 1978

To counteract soil acidity, 1 510 710 tons of calcitic and dolomitic agricultural lime and 25 167 tons of slaked lime were used.

Several research projects aimed at improving soil fertility and making more efficient use of fertilisers were tackled in the Highveld Region during the year under review. The fields of research covered by these projects include soil acidity, the reversal of harmful chemical conditions in a Hutton soil and the building up of the phosphate status of soil.

It was considered probable that the method used by the Region for determining lime requirements in order to improve acid soils was showing too much lime to bring the pH (H_2O) to 6.5. This assumption was confirmed in a laboratory test. It was also found that the method used by the Highveld Region produces divergent results for acid soils of the Hutton, Avalon and Clovelly forms. It is intended to carry out further research with these soils to determine the optimum soil pH for various field and pasture crops under field conditions and to test the response of soils with a variety of pH and clay content values to lime fertilising.

With regard to the reversal of adverse chemical conditions in a Hutton soil, several soil factors that restrict crop production were identified during the classification and mapping of the development areas. The areas where the problem appears to be urgent are the Argent development area in the Delmas district and the Clocolan development area in the Ladybrand extension ward. Both these areas are considered high-potential areas for maize and these studies are

therefore being tackled without delay in the above areas.

The problems receiving attention in the course of these studies are the low pH and phosphorus content, particularly of the subsoil, and the poor root development in the subsoil as a result of compaction. Trials were laid out in which various methods of reversing soil compaction are being tested, in addition to several methods of placing fertilisers at various depths.

Preliminary observations in respect of the placement of fertiliser indicate that deep placement of all fertiliser may have a beneficial effect. No definite trends were observed with regard to cultural practices aimed at improved root development following the reversal of the compaction of the subsoil. The exceptionally wet growing season may have contributed to the reversal of the harmful effects of soil compaction.

Observations indicate that the phosphate status of a soil can be built up more easily and rapidly using rock phosphates than with water-soluble phosphates. The desirable level to which the P status of a soil should be built up is still considered to be 30 ppm in red soils (Hutton-Shortland forms) and 20 ppm in yellow soils (Avalon Clovelly forms). The value of these figures for use as standards in planning P fertilising programmes and the value of the P source being used to improve the phosphate status are being investigated in field trials.

On the sandier soils (10 % clay) of the Ramah and other irrigation areas in the Free State Region the form in which nitrogen is applied is expected to be important. When fertilisers containing a high

percentage of nitrate nitrogen are used, severe nitrogen losses (N leaching) may be expected in sandy soils of this kind.

In a study in which the effectiveness of urea, ammonium sulphate and limestone ammonium nitrate were tested on a Mangano and Shorrock's soil series in wheat at Vaalharts, it was concluded that limestone ammonium nitrate and urea were the poorest of the three N sources in respect of yield on the sandy soils (10 % clay). This is ascribed to the possibility of N leaching. The various N sources functioned equally efficiently on the Shorrock's soil series (15 % clay) and none of the sources of nitrogen can really be considered preferable.

Urea, ammonium sulphate and limestone ammonium nitrate can be successfully used on soils in the Ramah irrigation area. However, ammonium sulphate is the most effective on all sandy soils (10 % clay) in the area.

Urea has certain disadvantages. Because hydrolysis is rapid a high concentration of ammonia is formed. If it is not well mixed with damp soil, ammonia can volatilise out of the soil, especially in soils with high pH values. If urea is applied together with the seed, the high concentration of ammonia may damage the germinating seed. Urea should therefore be judiciously applied. The effect of the application of molasses meal on the chemical and physical properties of a Mangano soil series was investigated under irrigation at the Sandvet Research Station. The results showed that the potassium contents of both the topsoil and the subsoil were significantly increased. The inability of the treatments to influence factors such as organic matter content, available moisture, matrix density and water-stable aggregates was striking. Neither did the treatments have any significant effect on the production of wheat, potatoes and cotton. In view of these negative results, the application of molasses meal to improve the structure cannot be recommended on similar soils under the same climatic conditions.

SOIL CONSERVATION

SOIL CONSERVATION RESEARCH

The Division of Agricultural Engineering plays an important part in soil conservation research. The research being undertaken at present is relevant chiefly to problems that crop up in the Karoo, the Eastern Cape and the Eastern Free State. Research there is linked chiefly to several aspects of donga erosion.

- In a stabilised water course in the Nieuwejaarspruit in the Upper Orange River Catchment where small mechanical structures have been built the effect of the unusual flooding of 1974 and 1976 was analysed. Although sediment losses were high as a result of both floods, they were significantly less where vegetation was well established. This trial also provided valuable information on the flow properties of flood waters.

- It was also established that it is possible to predict how far back the sediment effect of a proposed weir will be effective without doing a survey - a very important finding for the future planning of works.
- It is intended to survey a series of sediment slopes in the Eastern Free State and compare the results with the present figures. A short study showed that the sediment slope is about one and a half times as steep where there are trees as where there is no vegetation. When common reed was used the slope was half as steep again as the slope obtained with trees.
- At Spitskop, near Hofmeyer, a series of small works was constructed for testing various techniques and to serve as demonstration models. For experimental purposes the works were kept one metre high and the spillway of the one was level with the foot of the following one.
- With a view to developing a planning procedure, three areas where State works have already been constructed were investigated. The effect on the surrounding area and the quantity of sediment the works had trapped was noted. Much useful information, which will facilitate future planning and design, was obtained. The investigation is proceeding.

Research in the regions

The most important developments are summed up below.

- In the Natal Region research centred around the aspects of rainfall, soil erodibility and cover crops with regard to the part they play in the erosion model for determining soil losses (SLEMSA).
- Rainfall charts are being drawn up by the Faculty of Agriculture Engineering at Pietermaritzburg. To date the data from nine stations have been comprehensively analysed for periods varying from 2½ to 12 years.
- A method for determining the basic erodibility of a soil profile in the field was developed and successfully applied. It is intended that research work on soil erodibility will be undertaken on a contract basis by the University of Natal.
- The Engineering Section at Cedara took over 3 000 covercrop readings for various stands of maize plants. Two quadrat sighting frames received from Rhodesia were used. This programme will be extended to other crops.
- In the Transvaal Region the brack problems and waterlogging of irrigated land were investigated in the Hoedspruit area, where reduced production of conventional vegetable crops grown there was being encountered. Soil samples were taken and will be analysed to obtain further information.
- Soil conservation committee members in the Eastern Cape Region helped to determine progress with various registered and

unregistered programmes. They completed evaluation questionnaires for 98 farmers.

STATE SOIL CONSERVATION WORKS

The Soil Conservation Works Subdivision at Aliwal North, which is responsible for the surveying of sites and the design and drawing of plans and specifications for soil conservation structures, also has the necessary construction machinery and labour force to build State soil conservation works.

Table 1 shows the progress made with such works.

TABEL 1 - Construction of State soil conservation works

Year works	New works completed	Value (R)	Number of works repaired	Value (R)
1977/78	24	576 192	9	81 497
1976/77	19	798 382	17	84 831
1975/76	11	614 599	20	166 882
1974/75	17	463 137	25	217 830
1973/74	8	451 529	15	85 300
1972/73	3	765 759	7	149 317
1971/72	9	401 071	9	115 979

DIRECTIONS TO CONSTRUCT SOIL CONSERVATION WORKS

No directions to construct soil conservation

works were approved during the year under review.

RAILWAYS AND ROADWAYS

Incorrect cultural practices in the past have altered the natural flow of water in some cases and culverts at roadways and railways have been planned for the changed conditions. Run-off control planning and the adoption of correct conservation practices cause water to return to its natural channels, which may cause problems with existing culverts under roadways and railways.

In terms of a 1970 Cabinet decision the administration concerned effects the proposed changes and recovers the costs from the Department.

During the year under review claims amounting to R6 085 were received for four road culverts; claims for drainage works amounted to R1 600 and those for a waterway and soil conservation works to R962. The application of water run-off control planning may necessitate higher expenditure on claims in future.

SOIL CONSERVATION COMMITTEES

The Departmental investigation into the functioning of soil conservation committees was completed during the past year. A wide variety of matters were investigated, but only the most important findings are summed up below.

With regard to the tasks and functions of the committees, by far the majority of committee members and officers are in favour of the committees supplying advice to the Minister upon



A state work with cultivated common reed in the sediment basin



Spared veld above a weir in
South-West Africa

request. They agree that it is their responsibility to influence, persuade and advise the farming community on soil conservation. Their response to the question whether they could perform wider functions, namely in the field of farming development, policy formulation and involvement in optimum land use was favourable.

The chief problems appear to be that committee members' time is limited, that there is a lack of motivation and that poor co-operation is obtained from other farmers, with the result that contact between the committees and the farmers is not what it should be. Many committees also feel that they have too little authority. Notwithstanding all these problems, they are satisfied with their task and 77 per cent indicated that they were available for election again.

With regard to the suggestion that persons who contravene the Soil Conservation Act should be treated like traffic offenders, there were considerable differences of opinion. Thirty-four per cent of the committee members, 40 per cent of the members of farmers' associations and 63 per cent of the officers held this opinion, but 47 per cent of the committee members, 50 per cent of the members of farmers' associations and 33 per cent of the officers of the wards did not agree. The highly efficient committees did not agree with this opinion.

In the Natal Region the internal factors that affect the functioning of committees were investigated. It appears that in the highly efficient committees the majority of the factors of cohesion, purposefulness, participation, communication, technique, human relations and leadership were on a significantly higher level than in the case of less efficient committees. It may be concluded that,

since the level of efficiency of internal factors can be improved by training and the application of the knowledge acquired, it is possible to raise the level at which all committees function.

The recommendations of the Departmental Committee of Investigation are far-reaching, but are nevertheless being considered by the Department.

Soil Protection Advisory Board

During the past year the Board visited the Eastern Cape Region, where it acquainted itself with two extremely important problem situations, namely pineapple cultivation and the nassella threat. The pineapple situation presents extremely complex problems, since sophisticated mechanised practices are applied on slopes and soil classes that vary in degree of erodibility from very high to low. Notwithstanding these problems, the Board learnt that the Department is actively engaged in seeking a solution. Soil conservation guidelines for this area will be released shortly.

One of the serious nassella infestations in the Cathcart district was visited. The Board had the opportunity to view the weed from close quarters and become aware of the threat it poses to the Republic. As a result of the visit and the information obtained, Board members became very worried about the nassella threat in high potential grazing areas. It was clear that an integrated control programme will have to be drawn up and conscientiously applied over a long period by everyone concerned.

PLANNING OF FARMS AND SOIL CONSERVATION WORKS

During the past year 1 261 new plans were drawn up, as against 1 550 the previous year. The decrease in some regions may be ascribed to the reduction in the subsidy on fencing and stock watering points and to a rise in the cost of fencing materials. As Table 2 shows, about 73 per cent of the Republic has already been planned.

TABLE 2 - Planning of farms, 1977/78

Region	New planning	Supplementary planning and replanning	Total % of farms planned
Transvaal	320	183	66
Karoo	258	462	86
Natal	58	222	93
Highveld	205	255	54
Eastern Cape	69	503	82
Free State	219	663	71
Winter Rainfall	132	591	62
Average	180	411	73

TABLE 3 - Planning of farms and soil conservation works in South-West Africa

New planings	Supplementary planning and replanning	% of farms already planned
30	454	91

SUBSIDIES

A new subsidy system came into operation during the year under review. Since 1 October 1977 an increased subsidy of 75 % has been paid on protective works. In addition, a new sliding scale comes into operation when the subsidy on a particular work exceeds R750, but the accumulative subsidy on previous works is no longer taken into account. This sliding scale applies only to protective works. A subsidy of 55 % is paid on drainage works. From 1 October 1977 the existing subsidy of 55 % on grazing utilisation works (camp fences and stock watering points) was reduced to 40 % and it will be further reduced to 25 % from 1 July 1978.

From 1 July 1977 the following grazing utilisation works were no longer subsidised:

- the moving, repair or replacement of existing fences
- fences in which used material or locally felled hardwood was used
- fences for subdividing land camps, irrigated lands and areas where natural veld is being replaced with pasture crops
- fences forming part of crushes giving access to drinking troughs and erected for the purposes of one or another farm management practice

- stock watering points in lands and irrigation and other camps where the natural veld has been replaced by artificial pastures

Authority for grazing utilisation works granted prior to 1 July 1977 remains valid until the expiry date is reached. In order to qualify for a subsidy, such works should be constructed within the period of validity of the authority and written permission for the completion of the work should be obtained within the period mentioned.

Because of the changes in the subsidy system, farmers made considerable efforts to derive the maximum benefits before the basis on which subsidies on grazing utilisation works are granted is reduced. As a result they completed as much of the approved stock watering systems and inner camp fencing as possible and there was an incentive for them to notify the Department of and make statements on works already completed. As indicated in Table 4, a record amount of R7 million was disbursed in the Republic for completed soil conservation works.

Table 5 shows an amount of R2 million for South-West Africa.

Fewer subsidies were paid out to farmers in South-West during the past year than in the previous year, largely because of the decrease of activities in the northern subregion. The political and economic climate in this area is the main reason. A further reason is that over 90 % of the area has already been physically planned, so that there is a relatively smaller demand.

Table 6 reflects the categories of works subsidised during the past year.

The modified basis on which subsidies are paid meant that the Departmental Guide on the Application of the Soil Conservation Act had to be rewritten. A new system of water run-off control planning was also introduced. Since this forms an integral part of farm planning, the system has been designed in such a way that the run-off of surface water from lands can be safely disposed of in a controlled manner by means of waterways or pipes, stormwater furrows and contour banks. Run-off planning is seen in relation to catchment planning. The aim is to ensure that run-off water follows the natural flow pattern of the catchment as far as possible, so that erosion can be kept to a minimum.

Particulars of the practical application of run-off control planning are clearly set out in the Guide and the construction of protective works of this kind is expected to increase during the year under review.

A newly formulated policy of inter-departmental co-operation between the Division of Soil Protection and the Departments of Forestry, Water Affairs and Agricultural Credit and Land Tenure is clearly outlined in a Guide on the Application of the Soil Conservation Act.

TABLE 4 - Subsidies and grants paid out under the Soil Conservation Act

Financial year	Subsidies on completed soil conservation works R	Flood Repair Scheme R	Stock Reduction Scheme* R	Veld Reclamation Scheme* R	Grass Ley Crop Scheme* R
1948/70	20 973 154	103 516	-	2 124 563	287 299
1970/91	2 967 684	599	611 853	553 675	11 849
1971/72	3 023 651	2 219	7 906 502	366 542	13 000
1972/73	2 707 267	10 161	10 713 940	210 468	15 684
1973/74	2 567 339	8 674	9 046 140	43 976	7 688
1974/75	2 976 393	1 132	8 171 637	486	2 824
1975/76	3 591 150	158 680	6 354 693	-	200
1976/77	4 115 073	176 555	2 189 075	-	-
1977/78	7 188 311	93 996	363 921	-	-
Total	50 110 022	555 532	45 357 761	3 299 710	338 544

*Schemes already wound up

TABLE 5 - Subsidies and grants paid out in South-West Africa under the Soil Conservation Act

Financial year	Subsidies on completed soil conservation works R	Flood Repair Scheme grants R	Stock Reduction Scheme grants R
1971/72	1 019 143	-	321 900
1972/73	1 532 137	-	1 057 607
1973/74	1 965 943	-	1 292 931
1974/75	2 017 586	345	1 143 537
1975/76	2 179 683	1 693	1 001 383
1976/77	2 039 156	-	645 821
1977/78	2 017 897	773	150 819
Total	12 771 545	2 811	5 613 998

TABLE 6 - Kinds of work subsidised and amounts involved

	Republic (R)	South-West Africa (R)
Inner camp fencing	2 614 910	1 207 842
Stock watering points	2 103 946	800 724
Soil reclamation (erosion) fences	313 679	51
Soil conservation works	557 925	11 272
Contour banks	649 713	-
Brack control	948 804	-
Total	7 188 977	2 019 889

GRANTS

(a) Stock Reduction Scheme

The participation of the last five participants in the Stock Reduction Scheme, which was introduced on 1 October 1969 with 6 572 approved participants, ended during October 1978.

Table 7 gives particulars of participation, and Tables 4 and 5 show expenditure on grants.

An evaluation of the Scheme is being finalised at present and should appear next year.

(b) Veld Reclamation

The Veld Reclamation Scheme has already been wound up and no more grants are being paid out.

STATUTORY CONTROL

Proceedings were instituted in five cases during the past year and five convictions were obtained. One case is pending. From 1969 up to and including 30 June 1978 proceedings were instituted in 32 cases and 30 convictions were obtained. In view of the fact that a total of 9 414 problem cases were dealt with by the Division of Soil Protection during the same period, the relatively low number of prosecutions is evidence of the success achieved by the Department in persuading farmers to adopt sound conservation practices.

During the past year 14 directions were served and 346 problem cases were dealt with without it being necessary to serve directions. However, there are an additional 370 problem cases on hand, which brings the total number of cases being dealt with by the staff of the Division of Soil Protection to 1 765.

As Table 9 shows, directions were served on seven farms that were added to the list during the year, but since more than one agricultural abuse may occur on the same farm, a larger number of directions could clearly be served (Table 10).

DISASTER RELIEF

During the year under review the Minister of Agriculture approved flood relief grants for the following districts: Humansdorp, Hankey, Kirkwood, Uitenhage, Brits, Marico, Thabazimbi, Swartruggens and Rustenburg.

Expenditure on relief under the Scheme, shown in Tables 4 and 5, was accounted for chiefly by payments for flood damage in 1974 and 1976.

SUBDIVISION OF AGRICULTURAL LAND

Applications for subdivision, undivided shares, township development and other non-agricultural uses have fallen into a fixed pattern since the commencement of the Act in 1971. Since applications are rigorously screened at all levels before being submitted, it was possible to

TABLE 7 - Participation in the Stock Reduction Scheme

Region	Number of approved participants	Participants who left the scheme up to 30 June 1978 as a result of -					Number of participants on 30 June 1978
		(a) Changed conditions	(b) Expulsion	(c) Change of ownership	(d) Recovery of veld	(e) Completion of period	
Karoo	3 127	300	20	198	28	2 579	2
Free State	1 595	394	21	157	63	960	0
Eastern Cape	992	134	45	102	46	664	1
Winter Rainfall	419	16	5	24	6	368	0
South-West Africa	439	6	1	44	57	329	2
Total	6 572	850	92	525	200	4 900	5

TABLE 8 - Number of farms on which contraventions were alleged to occur and cases dealt with during the year under review

Region	Carried over from the previous year	New cases during year under review	Dealt with during year under review	Total pending
Highveld	145	81	63	163
Karoo	333	67	44	356
Natal	332	15	52	295
Eastern Cape	126	26	10	142
Free State	121	80	41	160
Transvaal	243	37	33	247
Winter Rainfall	266	59	93	232
South-West Africa	175	5	10	170
Total	1 741	370	346	1 765

TABLE 9 - Number of farms in respect of which directions were served and dealt with during the year under review

Office	Carried over from previous year	New cases during year under review	Dealt with during year under review	Total pending
Highveld	15	1	2	14
Karoo	17	-	1	16
Natal	16	5	-	21
Eastern Cape	17	-	2	15
Free State	13	-	-	13
Transvaal	26	-	-	26
Winter Rainfall	17	1	2	16
South-West Africa	-	-	-	-
Total	121	7	7	121

grant a very high percentage.

As is apparent from Table 1(a), a fairly constant pattern of 75 per cent approvals and 25 per cent rejections is developing. Since the number of applications during the period 1974-07-01 to 1975-06-30 reached a peak of 1 142, there has been a systematic decline, so that only 728 applications were dealt with during the year under review. This systematic decline is related to the general state of the national economy, and particularly to the present depressed state of the property market.

The pattern in respect of approved and rejected leases and servitudes (Table 1(b)) has also

TABLE 10 - Alleged contraventions of the Soil Conservation Act, number of farms on which directions were served and number of directions served, 1969 to 30 June 1978

Period	Number of alleged contraventions	Number of farms on which directions were served	Number of directions served
1969-1977	9 044	187	446
1977-1978	370	8	14
Total	9 414	195	460

TABLE 11 - Prosecutions under the Soil Conservation Act, 1969 to 30 June 1978

Period	Contraventions referred to Attorney-General	Prosecutions instituted	Convictions	Cases pending
1969-1977	44	27	25	0
1977-1978	3	5	5	1
Total	47	32	30	1

remained fairly constant.

Of the 728 applications (Table 1(a)) dealt with during the past year, 568, i.e. 78 per cent, are intended exclusively for agricultural purposes. Of these 568 applications, 134 or 24 per cent were rejected - a slightly higher figure than the average for the entire period. The reason is probably the general shortage of capital in the country. More landowners than in the past are trying to acquire capital by selling small pieces of land.

Permission for the creation of new units and for the vesting of agricultural land in more owners necessarily resulted in an increase in the number of owners and farms. Nevertheless, statistics show that as a result of the consolidation of properties and other conditions, the number of owners and farms decreased by 264 during the past year. Three hundred and sixty farm units, which did not comply with the minimum requirements for farm size, also disappeared in the process. This brings the total since 2 January 1971 to 2 981, involving 1 261 950 ha. On the other hand, only 96 new farm units have been created, which brings the total for the entire period to 1 051.

The position is therefore that a large percentage of the applications submitted merely

TABLE 1 Number of applications dealt with under the Subdivision of Agricultural Land Act, 1971-01-02 to 1978-06-30

1(a) - Applications for subdivision, vesting of undivided shares, township development and incorporation into areas of jurisdiction of municipal and similar bodies

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1971-01-02 to 1971-06-30	331	67	153	33	489
1971-07-01 to 1972-06-30	725	74	252	26	977
1972-07-01 to 1973-06-30	659	81	157	19	816
1973-07-01 to 1974-06-30	715	74	253	26	968
1974-07-01 to 1975-06-30	848	74	294	26	1 142
1975-07-01 to 1976-06-30	738	76	239	24	977
1976-07-01 to 1977-06-30	678	77	203	23	881
1977-07-01 to 1978-06-30	551	76	177	24	728
Total	5 245	75	1 733	25	6 978

1(b) - Applications in respect of leases and servitudes

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1972-07-01 to 1973-06-30	72	98,6	1	1,4	73
1973-07-01 to 1974-06-30	92	98	2	2	94
1974-07-01 to 1975-06-30	68	89	8	11	86
1975-07-01 to 1976-06-30	49	94	3	6	52
1976-07-01 to 1977-06-30	60	97	2	3	62
1977-07-01 to 1978-06-30	53	96	2	4	55
Total	394	95	18	5	412

TABLE 2 - Subdivision for agricultural purposes exclusively

Period	Approvals		Rejections		Total
	Number	%	Number	%	
1972-01-02 to 1971-06-30	246	73	92	27	338
1971-07-01 to 1972-06-30	617	86	101	14	718
1972-07-01 to 1973-06-30	494	83	99	17	593
1973-07-01 to 1974-06-30	611	85	105	15	716
1974-07-01 to 1975-06-30	775	80	166	20	831
1975-07-01 to 1976-06-30	576	77	170	23	746
1976-07-01 to 1977-06-30	598	85	107	15	705
1977-07-01 to 1978-06-30	434	76	134	24	568
Total	4 241	81	974	19	5 215

TABLE 3 - Number of farm units created, and number of area of farms consolidated with other land, 1971-01-02 to 1978-06-30

Period	New farm units created	Consolidation	
		Number of farm units	Area ha
1971-01-02 to 1971-06-30	233	116	48 951
1971-07-01 to 1972-06-30	152	436	103 799
1972-07-01 to 1973-06-30	134	342	88 178
1973-07-01 to 1974-06-30	116	503	164 353
1974-07-01 to 1975-06-30	153	523	174 203
1975-07-01 to 1976-06-30	61	385	173 122
1976-07-01 to 1977-06-30	107	316	217 321
1977-07-01 to 1978-06-30	107	360	287 018
Total	1 051	2 981	1 261 950

involve the conversion of existing properties to new units, which often results in a reduction in the number of units.

Subdivision of agricultural land for non-agricultural purposes

Table 4 shows the application for subdivision for non-agricultural purposes, broken

down into applications for -

- Extensive occupation, commercial purposes, resorts and mining
- Intensive urban use

The number of applications for extensive occupation, commercial purposes, resorts and mining has remained virtually constant over the past two years, namely 106 as against 104. The percentage of approvals increased considerably, however, in comparison with the previous year - 57

TABLE 4 - Subdivision for non-agricultural purposes - number of applications and area involved

Period	(i) Extensive occupation, commerce, resorts and mines						(ii) Intensive urban use					
	Approved			Rejected			Approved			Rejected		
	Num- ber	%	ha	Num- ber	%	ha	Num- ber	%	ha	Num- ber	%	ha
1971-01-02 to 1971-06-30	74	54	2 612		46	7 244	11	92	1 426	1	8	66
1971-07-01 to 1972-06-30	129	56	2 825	100	44	8 259	29	97	1 152	1	3	13
1972-07-01 to 1973-06-30	91	63	3 879	53	37	3 998	74	94	10 763	5	6	1 338
1973-07-01 to 1974-06-30	105	50	3 361	103	50	6 975	90	98	8 133	2	2	432
1974-07-01 to 1975-06-30	86	43	3 706	113	57	5 700	97	95	13 751	15	5	3 296
1975-07-01 to 1976-06-30	75	54	2 248	63	46	2 704	75	90	16 576	8	10	868
1976-07-01 to 1977-06-30	14	13	2 396	92	87	5 973	66	94	44 292	4	6	70
1977-07-01 to 1978-06-30	59	57	2 097	45	43	777	40	100	22 985	0	0	6 083
Total	557	49	23 144	633	51	41 630	482	95	109 078	36	5	6 083

per cent as against 13 per cent. This figure of 57 per cent is in line with the trend from 1971 to 1976. Notwithstanding the fact that the number of approvals increased from 14 to 59, the area dropped by 99 ha. The reason is that last year there were a few cases involving extensive areas, which was not the case during the year under review.

There was, however, a big drop in the area involved in rejections, which in fact decreased from 5 973 ha the previous year to 777 ha during the past year. This trend should be ascribed chiefly to the fact that there were virtually no applications for resorts during the past year, as a result of the economic climate, whereas rejected applications for resorts used to account for the biggest area. Better communication between all the parties concerned also resulted in few poorly founded applications being received by the Department.

Not a single application for township foundation was formerly rejected during the year under review - an unusual achievement. As in the previous case, this is an indication of the excellent understanding between all the parties involved at present. The general position with regard to property development makes it essential for prospective developers to make certain that there are opportunities for development before they incur major expenditure.

During the year under review 22 985 ha was nevertheless allocated for intensive urban use. This is less than the 44 292 ha allocated the previous year, but nevertheless the second highest figure allocated since 1971. The size of the area is accounted for by the fact that Velddrif's area of jurisdiction was enlarged by 19 938 ha, chiefly by including the commonage, which has virtually no agricultural value. The same applies to the 462 ha at Simonstown, the 494 ha at Melkboschstrand, the 236 ha at Yserfontein (Malmesbury district), the 463 ha near Eerste River on the Cape Flats and the 101 ha at Humansdorp. All this land consists of coastal sand of very recent geological origin, with very little agricultural potential. Although 21 694 ha is being withdrawn from agricultural use, the loss to agriculture in real terms is negligible.

The activities of the Subdivision Section

comprise not only the activities reflected in the preceding tables, but also the following:

1. Co-ordination and interpretation of the report on potential for the Department of Agricultural Credit and Land Tenure.
2. Work on guide plans in co-operation with the Department of Planning and the Environment.
3. Activities in respect of the Planning Advisory Council to the Prime Minister's Subsidiary Committee for the Disposal of State Land.
4. Activities in respect of the allocation of agricultural land for new roads and railways to the Department of Defence, Armscor and Nature Conservation.

WEED CONTROL

RESEARCH

Nasella tussock remains a serious threat to the veld and artificial pastures in the high-lying eastern parts of the Republic. The results of experiments in progress at present confirm that Dalapon sprayed during January and February at a dosage of 49 kg/ha effectively kills well-developed stands of nasella, but that the plants rapidly re-establish themselves from seed unless further treatment is applied. It appears from the results obtained that there is economic justification for applying Dalapon to adult nassella plants at a dosage of only 20 kg/ha, followed by patch spraying of the surviving plants. Glyphosate at eight litres/ha was as effective as Dalapon in most cases. There were again indications that the quantity can be halved if follow-up patch spraying is applied, preferably with the addition of ammonium sulphate to the spray.

The burning of nassella one to two months after spraying with Dalapon increases the effect of spraying and consequently the quantity of weedicide can be reduced. It is also clear from the results that burning stimulates the germination of

nassella seed. This could be exploited, e.g. by boosting the germination of seed reserves through burning. Burning is followed by relatively cheap spraying of the seedlings. Burning that is not followed immediately by spraying is undoubtedly dangerous.

During the past year comparative trials were carried out on jointed cactus and prickly pear using several concentrations of the weedkiller 2,4,5-TP, in aqueous solution. Another five weedkillers are being tested at the same time. The trials are still at an early stage so that no evaluation is possible as yet.

In view of the present economic climate it is essential to find a water-soluble weedkiller for the control of opuntias.

The biological control of jointed cactus is proceeding. The Weeds Laboratory at Uitenhage has made good progress in this connection. Trials with various weedkillers were also carried out on *Sesbania punicea*. An evaluation will be done shortly.

Prosopis distribution in the Karoo Region

The survey carried out with the aid of questionnaires to determine the area and degrees of

infestation showed that 83 499 ha is sparsely infested (less than 100 trees per ha), 44 808 lightly infested (100-350 trees/ha), 33 875 ha moderately infested (350 - 1 000 trees/ha) and 24 525 ha totally penetrated (over 1 000 trees/ha) - a total infestation of 186 707 ha, which is a fairly serious situation.

A project aimed at finding suitable chemical control measures for the eradication of *Prosopis* spp. was started in the North-Western parts of the Karoo Region during November 1977. The project is being carried out on the properties of two collaborators in the Kenhardt district.

The following treatments and concentrations of weedkiller are being tested:

- (a) Foliar spraying on seedlings (Tordon 101 and Tordon 225)
- (b) Stem treatments on cut seedlings, shrubs and adult trees (power paraffin, power paraffin plus 2,4,5-T, diesel oil plus 2,4,5-T and diesel oil plus Tordon 155)
- (c) Soil treatment on shrubs and adult trees (Hyvar XG10)

Power paraffin and diesel oil appear to produce good results only on cut seedlings and shrubs. Foliar spraying on seedlings with Tordon 101 and Tordon 225 also produces significant results.



Nassella tussock *Stipa trichotoma* has become a serious threat to pastures in the high-lying eastern parts of the country

Eastern Cape Region

Since 1957 the State has spent about R9,13 million on spray for controlling jointed cactus. Good progress has been made, but there is little prospect of eradicating the weed completely. The jointed cactus infestation spreads every year. Old-established infestations are discovered regularly. There is also slight natural spread or expansion.

There are 1 700 applicants in the inspection area who have applied for the use of free spray or for participation in the programme. This is an increase of 541 applicants, or 46,6 per cent since 1964.

The total area of farms in the inspection area infested with jointed cactus increased from 1 212 157 ha during the first evaluation analysis in June 1964 to 1 667 951 ha in June 1978. This means that the inspection area has expanded by 455 794 ha during the total period, and by 22 382 ha during the past year - increases of 37,6 per cent and 1,8 per cent respectively.

During the first evaluation analysis in June 1964, 643 719 ha in the inspection area was classified as infested. This area increased by 187 811 ha (29,1 %) and at present 831 530 ha is infested.

Inspections undertaken to evaluate the situation indicated that 394 196 ha (61 %) of the veld that had been infested has been brought under control. By June 1978 673 867 ha (81 %) of the 831 530 ha actually infested was under control.

An additional 11 450 ha was found to be under control during the most recent evaluation, which represents an advance of one per cent on the total area infested.

Tables 6 and 7 show the situation and the progress made with the control of jointed cactus in the Eastern Cape and Karoo Regions. The biggest cost item in the control of jointed cactus is spray.

Total quantities of spray issued at the spray depot at Fort Beaufort are shown in Table 5(i); the figures include spray issued outside the inspection area.

As indicated in Table 5(i), the consumption of spray has risen despite the rationing system introduced. This reflects the need for more spray.

PRICKLY PEAR AND IMBRICATE CACTUS

The prickly pear control programme is making very slow progress, owing to the jointed cactus campaign, the shortage of labour, the R5 per drum farmers have to pay and the high railage.

HAKEA

Good progress was made with the control of hakea in the Port Elizabeth district and the entire district is under control at present. A sustained control programme is still in progress at Humansdorp, where 99 farmers/bodies are engaged in applying control measures.

It is estimated that hakea occurs on about 34 000 ha.



Opuntia rosea before chemical treatment



Opuntia rosea three months after spraying with a weedicide

TABLE 5(i) - Quantities of spray issued at the spray depot at Fort Beaufort, 1957 to 1978 (litres)

Year	Jointed cactus	Imbricate cactus	Prickly pear	Total
1957/1961	12 952 858	-	845 718	13 798 576
1961/1965	21 058 560	-	2 166 996	23 225 556
1965/1969	30 333 733	82 482	1 403 725	31 930 940
1969/1973	22 453 705	120 033	381 511	22 955 249
1973/1976	12 663 600	54 200	224 200	12 942 000
1976/1977	3 766 800	11 000	92 400	3 870 200
1977/1978	4 169 400	11 600	263 200	4 444 200
Total	197 509 656	279 315	5 377 750	113 166 721

TABLE 5(ii) - Average quantities of spray issued per year, 1957 to 1976 (litres)

Year	Jointed cactus	Imbricate cactus	Prickly pear	Total
1957/1961	3 238 214	-	211 430	3 449 644
1961/1965	5 264 640	-	541 749	5 806 389
1965/1969	7 611 183	20 621	350 931	7 982 735
1969/1973	5 613 426	30 008	95 378	5 738 812
1973/1976	4 221 200	18 067	74 733	4 314 000

SESBANIA PUNICEA

This beautiful shrub with its orange-red flowers is spreading rapidly and constitutes a new threat to the natural vegetation. There is strong pressure to have it declared a noxious weed.

TABLE 6 - Jointed cactus infestation in the Eastern Cape Region and the efficiency of control measures, 30 June 1964 to 30 June 1978

Year	Number of owners/occupiers	Size of properties (ha)	Infested veld (ha)	Veld not infested (ha)	Lands not infested (ha)	Infested veld under control (ha)	Control (owners)		
							Effective	Fairly effective	Ineffective
June 1964	957	788 444	471 049	291 076	26 319	259 800	385	270	302
			60 %	37 %	3 %	55 %	40 %	28 %	32 %
June 1968	1 271	969 419	569 248	365 468	34 703	428 104	890	272	109
			59 %	38 %	3 %	75 %	70 %	21 %	9 %
June 1972	1 364	1 057 679	598 548	424 370	34 761	458 530	954	277	133
			57 %	40 %	3 %	77 %	70 %	20 %	10 %
June 1976	1 416	1 083 125	603 883	441 232	38 010	459 088	1 019	232	165
			56 %	41 %	3 %	76 %	72 %	16 %	12 %
June 1977	1 424	1 074 080	602 865	433 176	38 039	466 208	1 046	228	150
			56 %	40 %	4 %	77 %	73 %	16 %	11 %
June 1978	1 416	1 097 304	605 796	451 815	39 693	475 652	976	266	174
			55 %	41 %	4 %	79 %	69 %	19 %	12 %

TABLE 7 - Jointed cactus infestation in the Karoo Region and the effectiveness of control measures, 30 June 1964 to 30 June 1978

Year	Number of owners/occupiers	Size of properties (ha)	Infested veld (ha)	Veld not infested (ha)	Lands not infested (ha)	Infested veld under control (ha)	Control (owners)		
							Effective	Fairly effective	Ineffective
June 1964	202	423 714	172 670	244 671	6 373	134 396	126	60	16
			41 %	58 %	1 %	78 %	62 %	30 %	8 %
June 1968	240	462 878	188 402	264 281	10 195	158 651	170	65	5
			41 %	57 %	2 %	84 %	71 %	27 %	2 %
June 1972	276	545 594	210 212	326 933	8 449	162 503	219	42	15
			39 %	60 %	1 %	77 %	79 %	15 %	6 %
June 1976	285	560 901	221 181	331 329	8 391	191 718	213	42	29
			40 %	59 %	1 %	87 %	75 %	15 %	10 %
June 1977	283	571 489	225 730	336 930	8 829	196 209	178	58	47
			39 %	59 %	2 %	87 %	63 %	20 %	17 %
June 1978	284	570 647	225 734	336 031	8 882	198 215	197	42	45
			40 %	59 %	1 %	88 %	60 %	15 %	16 %

Karoo Region

Proclaimed weeds got completely out of hand during the past good season and the majority of farmers are not enthusiastic about applying control measures.

JOINTED CACTUS

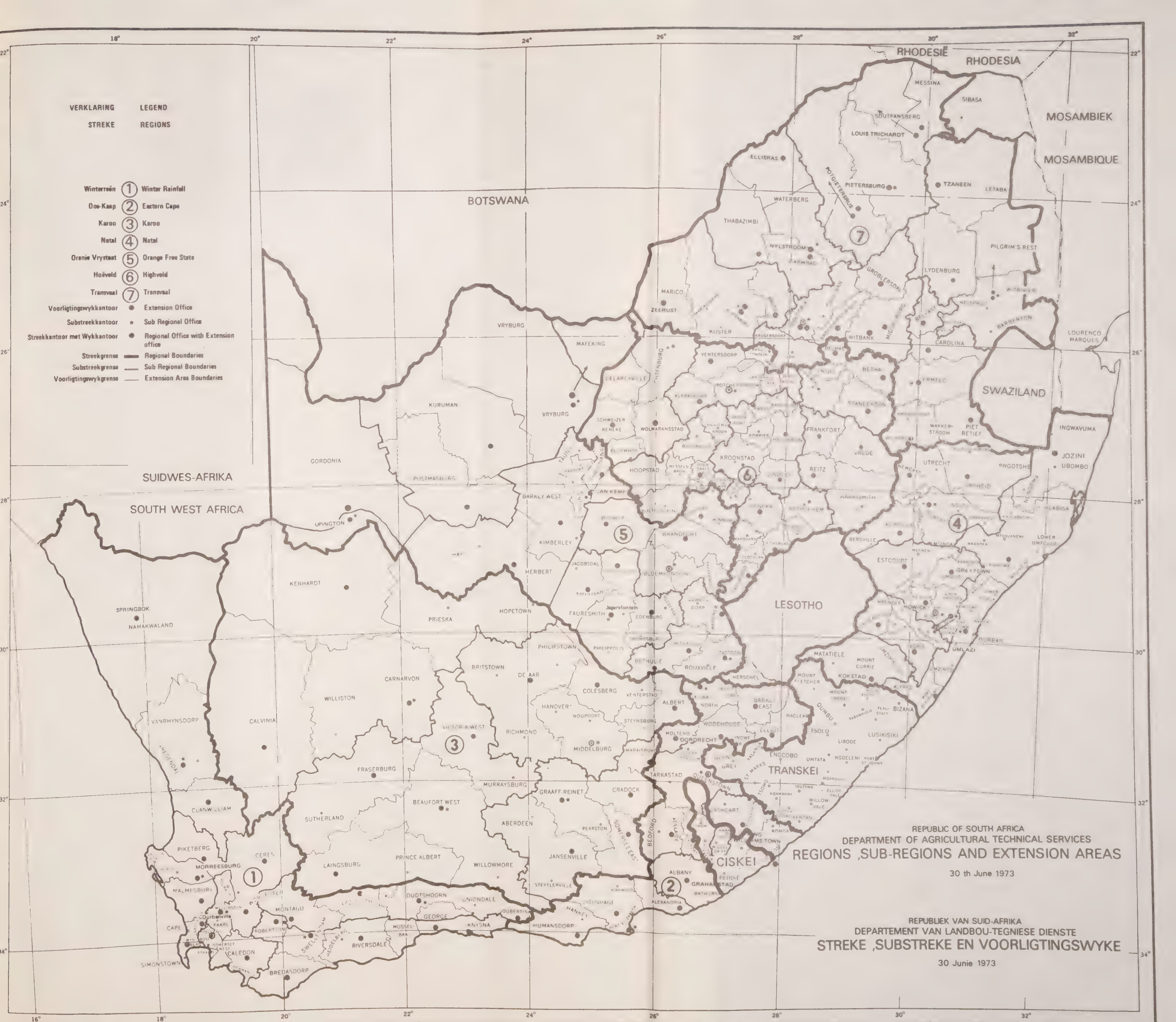
At present an area of 226 397 ha is infested, 198 879 ha of which is under control. The total number of owners concerned is 284. Weed inspectors carried out 542 inspections in infested areas during the past year, as against 473 during the previous year.

SCALY CACTUS

Control measures have been fairly effective. The area infested at present is 16 946 ha, 16 047 ha of which is under control.

SILVERLEAF BITTER APPLE

The area infested covers 5 400 ha, 2 603 ha of which is heavily infested, 1 550 ha moderately infested and 1 247 ha lightly infested. The heaviest infestation occurs in the Kendrew irrigation area next to the Sundays River. No weedkiller has so



SUIDWES-AFRIKA SOUTH WEST AFRICA

-  Hoofkantoor en Substreekkantoor/
Head Office and Subregional Office
-  Landboukollege/
College of Agriculture
-  Navorsingstasie/
Experimental Station
-  Voorligtingskantoor/
Extension Office
-  Substreekkantoor/
Subregional Office
-  Noordelike Substreek/
Northern Subregion
-  Sentrale Substreek/
Central Subregion
-  Suidelike Substreek/
Southern Subregion



far been registered for control and consequently very little is being done about the matter.

NASSELLA TUSSOCK

Nassella tussock occurs in the Somerset East, Pearston, Graaff-Reinet and Cradock districts. The total farm sizes on which infestation occurs amount to 120 011 ha, with 1 134 ha of the veld being heavily infested, 5 059 ha moderately infested and 24 019 ha lightly infested. The Department is busy with a co-ordinated attempt to start an effective control campaign.

Several trials were carried out in the Winter Rainfall Region in order to evaluate the efficacy and phytotoxicity of certain preparations, chiefly registered weedkillers.

- The sensitivity of ten wheat cultivars to difenzoquat was investigated at Langgewens. Although they were not significant, the same trends as in previous experiments showed up in respect of sensitive and insensitive cultivars. The cultivars Flameks, Liesbeeck, Memnon, SST3 and SST16 appear to be relatively insensitive, with Elize, Inia, Kasteel, K20 and Sonderend showing signs of slight sensitivity.
- The grass weedkiller dichlofopmethyl was tested at dosages of 0,2, 0,3, 0,4 and 0,5 kg of active ingredient per ha at Welgevallen and Stellenbosch. All the treatments produced good or even outstanding control of rye-grass in wheat. The 0,4 kg/ha dosage produced the highest yield, namely 172,2 % higher than the yield of the control. In the same trial a mixture of dichlofopmethyl and bromoxynil at a dosage of 0,3 + 0,4 kg of active ingredient per ha also provided excellent control of rye-grass and resulted in an increase of 156,5 % in the crop.
- In a trial on the farm De Grendel at Malmesbury all the available preparations for

controlling wild oats, and the new preparation flampropmethyl, were evaluated. Dichlofopmethyl at dosages of 0,3, 0,4 and 0,5 kg of active ingredient per ha, difenzoquat and flampropmethyl all provided complete control of wild oats. For inexplicable reasons benzoylprop ethyl provided poor control. Barbamate was not sprayed because the wild oats had already grown too big. All the treatments produced higher yields than the control. However, the yields did not differ significantly from each other.

- A number of registered weedkillers were evaluated on Inia wheat in a trial at the Tygerhoek Experimental Farm. The differences in yield were not significant. The preparations methabenzthiazuron, bromoxynil and bromfenoxim all produced outstanding control of broad-leaved weeds. Methabenzthiazuron + MCPA mixture and MCPA produced poor control, for some inexplicable reason.

- In pot trials under glasshouse conditions at Welgevallen a number of preparations were provisionally evaluated as pre-emergence weedkillers for wheat. The preparations were investigated chiefly for their ability to control *Raphanus raphanistrum* (wild radish) and *Emex australis* (devil's thorn). All the preparations that were not phytotoxic to wheat produced poor control of one or both these weeds. The mixture of metribuzin and pendimethalin (Sencor + Stomp) was the exception, and provided good control of wild radish and fair control of devil's thorn. This mixture also proved to be only slightly phytotoxic to the wheat cultivar Inia, which was used in the trial.

V. Entrepreneur Development

AGRICULTURAL EXTENSION SERVICES

In agriculture the farmer, as the primary producer, is regarded as the entrepreneur. All activities aimed at the development of the entrepreneur, namely extension and training, are the primary task of the regional organisations of the Department.

With the dynamic nature of the agricultural industry in mind, a few new trends will be sketched by way of introduction.

NEW TRENDS AND PROBLEMS

WINTER RAINFALL REGION

The following new trends were evident on the agricultural scene during the past year:

- (a) Plantings of white wine grape cultivars tended to increase at the expense of red grape cultivars.
- (b) Greater diversification in wine grape enterprises, with the inclusion of vegetables, dairy farming and meat production.
- (c) Greater inclusion of livestock in crop farming areas and increased interest in the establishment of grass clover pastures.
- (d) Saving on fertiliser costs, pre-fertilising before planting, greater use of Departmental soil analysis services and fertilising recommendations.

SOUTH-WEST AFRICA REGION

The following trends are evident, particularly in the northern part of the Region:

- (a) A switch from weaner calf to ox production
- (b) Aerial spraying of bush
- (c) Use of burning to control bush encroachment, because of high spraying costs
- (d) Interest in the cultivation of cash crops

KAROO REGION

- (a) The change in the basis on which grazing utilisation works (camp fences and stock-watering points) are subsidised has contributed largely to a new approach in extension: the subsidy aspect is becoming less important in the process of persuasion, whereas knowledge of the various farming enterprises is becoming a more important factor.

- (b) It is evident that there is greater interest in the natural vegetation and the discriminate utilisation of grazing. This is confirmed by the increasing popularity of the "know-the-veld" days, during which plant identification and veld evaluation in particular are emphasised.
- (c) Farmers have become increasingly conscious of the feeding question, and the trend these days is to start feeding as soon as normal drought conditions occur in order to keep livestock in a reasonable condition and to prevent dry matter on the veld from becoming seriously depleted and trampled.
- (d) Mainly as a result of prices and price differences, Angora goats have become strongly competitive with Boer goats, as is the case with woolled and mutton sheep, and interest in game farming is increasing.

EASTERN CAPE REGION

The following were observed:

- (a) A switch from Angora goats to Boer goats, particularly in areas where Angora goats are not adapted
- (b) A switch from beef cattle to sheep, as a result of the red meat dilemma
- (c) A swing away from beef cattle farming towards dairy farming.

FREE STATE REGION

The following were observed in this Region:

- (a) An increase in Karakul pelt production and a decrease in beef farming
- (b) A decrease in the area planted to lucerne and an increase in cotton plantings under irrigation
- (c) A trend among farmers at Douglas to switch from seed potato production to groundnuts and cotton
- (d) A decrease in sunflower production
- (e) Interest in artificial pastures is increasing as a result of the rising production cost of cash crops.

HIGHVELD REGION

Certain new trends have emerged in the field of extension.

- (a) Extension programmes are no longer limited to the development areas, but have been expanded to include the whole farming community inside any extension ward. Extension areas that are reasonably homogeneous in potential and representative

of the development area are demarcated and communities inside these areas are then involved in the extension programme by means of study groups. This trend may necessitate redemarcation of extension wards on a basis of reasonably homogeneous agricultural potential in future.

- (b) Extension programmes are still based on the treatment of farms as units and systematic development takes place from the most basic principles to optimum production. The aim is to familiarise the farmer with the resources he is developing, to enable him to take his own decisions, sensibly, and without falling back on set formulas. Programmes aimed at isolated problems are avoided at all costs.
- (c) Active attempts are made to involve not only the progressive farmers but also the average farmers in extension programmes. Consequently a message that is capable of reaching the average farmer and being understood by him has to be put across. By keeping the message simple, to the point and practical, this aim can be achieved.

The following new trends emerged on the farm and enterprise level:

- (d) The total area under grain sorghum and sunflowers is increasing. In the Lichtenburg Subregion, however, there was a decrease in sunflower plantings but an increase in the area under groundnuts.
- (e) Fertilising according to soil potential is increasing among farmers. There is also an increase in the use of nitrogen fertiliser.
- (f) Farmers are beginning to realise the value of soil classification and the demand for this service is therefore increasing.
- (g) Chemical weedkillers are being used on an increasing scale.
- (h) More use is being made of lower-potential soils for perennial pasture crops.
- (i) In the Harrismith Subregion sheep numbers are showing an upward trend, while sheep numbers in the Kroonstad Subregion are showing a decrease in favour of cattle.

TRANSVAAL REGION

- (a) As a result of the success achieved with winter wheat on the Springbok Flats under dryland cultivation, the practice has now been expanded to marginal lands with a lower moisture-retaining capacity. During years with normal rainfall this trend will undoubtedly cause problems.
- (b) As a result of good rainfall during the past three seasons there is a greater tendency to include dryland crop cultivation in beef farming.
- (c) There was a clear tendency among irrigation farmers to cultivate larger quantities of flue-cured tobacco at the expense of potatoes and tomatoes. This tendency may contribute to an overproduction of flue-cured tobacco.

NATAL REGION

- (a) In spite of the favourable climatic conditions that prevailed in the Region, the nett income from dairy products, beef and sheep decreased. Fuel and fertiliser prices has risen sharply, while the price of beef and mutton remained virtually the same. There were, however, small increases in the prices of fresh milk, industrial milk and wool.
- (b) In Griqualand East there has been a swing to sheep, and in particular to fat lamb production. Greater emphasis is being placed on veld and artificial pastures for the overwintering of stock. A larger area has become available for cash crops such as maize. As a result of the high cost of making hay and silage, there was been a swing to perennial pastures that retain their nutritional value in winter, such as kikuyu, cocksfoot and fescue.
- (c) The generally adverse economic climate, and in particular the higher production costs and relatively low prices received by farmers for beef, are clearly having a detrimental effect on farming in the Natal Midlands. This is aggravated by the problems experienced by beef producers in obtaining permits to sell to abattoirs. The result is a movement away from intensive beef production on artificial pastures and expensive home-grown feed to extensive pastures.
- (d) There has clearly been an improvement in the efficiency of dairy farming in the Natal Midlands with the increased use of pastures as the main source of feed. This can be attributed mainly to the fact that the dairy team of the Region placed greater emphasis on improved techniques in the planning of feed flow programmes.
- (e) As a result of the economic climate of the past two years there has been a notable increase in vegetable plantings, particularly in the case of the more intensive farming operations in the Midlands Subregion of Natal.
- (f) In the Northern Natal Subregion there is growing interest in maize production. Both horizontal and vertical expansion is taking place at present. Beef production is at present taking place mainly on pastures. A greater interest in vegetable farming can also be discerned.
- (g) In general farmers have become more conscious of fire fighting and there is great interest in fire fighting organisations.
- (h) Among the sugar farmers in Natal there has been a decided swing to alternative crops as a replacement for sugarcane because of the 23 % decrease in the sugar quota. There is particular interest in cabbage, tomatoes, green beans, potatoes, madumbi, soya-beans, cotton, groundnuts, ginger, coffee and avocados as alternatives to sugar-cane.

- (i) The area planted to bananas in the coastal parts of Natal is gradually expanding. This trend developed with the establishment of the Natal Banana Co-operative, which provides greater stability, not only for bananas but also for other subtropical fruit cultivated in this area.
- (j) The trend among farmers at Mkuze and Hluhluwe to establish cotton in large areas which were previously pastures and old sisal lands is continuing.

PROGRESS WITH EXTENSION PROGRAMMES AND LIAISON PROJECTS

WINTER RAINFALL REGION

- (a) The first phase of area development, namely the demarcation of homogeneous agricultural areas, was given priority and very good progress has been made.

In view of the Department's attitude to the task of optimum land use all the extension projects were reviewed critically, with the result that only projects aimed at the realisation of optimum land use are being continued.

Attention is already being paid in extension programmes to the shortcomings identified in practice. The following practices in the extension programme of the Boland Subregion are enjoying priority:

- (b) *Vineyard pruning*: In addition to the viticultural programme at Stellenbosch, where six demonstrations were held, another 13 demonstrations, attended by 265 farmers, were held in the Subregion as well as four panel discussions, attended by about 430 farmers.
- (c) *Soil demonstrations*: Following two big panel discussions, attended by approximately 200 farmers, which were held in co-operation with OVRI, seven soil days were held at Robertson, three at Ceres, one at Wellington and six at Stellenbosch, the attendance being 280.
- (d) *Establishment advice*: Apart from the many cases where farmers were given informal advice, based on existing soil data, on establishment, the 88 producers in the Worcester, Wellington and Stellenbosch wards were given establishment advice, based on thorough soil examinations and sampling, in respect of crop selection, soil preparation, liming, choice of irrigation system, etc. At Ceres a similar task was carried out on an area of nearly 800 ha. In the Wellington ward this task included 68 farm visits.
- (e) *Soil sampling*: In the Wellington and Worcester wards soil sampling was carried out in order to make recommendations on irrigation, drainage and fertilising. For this

purpose 471 samples were taken and 441 profile examinations carried out.

- (f) *Progress with projects*: There are 56 registered extension projects in the Region; they are divided into the following categories:

• Production efficiency - wheat	7
• Artificial pastures	3
• Natural pastures	7
• Resource classification	8
• Resource planning	5
• Soil conservation	19
• Viticulture	4
• Pomes and drupes	3
Total	56

Information on progress with some of these projects is given below.

(i) Wind erosion programme on Berg River Farms

This project was completed this year. In all, 80 % of the 15 farmers were persuaded to protect effectively 1 700 ha (89,5 %) of the 1 902 ha that is subject to wind erosion. The three farmers who would not co-operate after repeated attempts at persuading them have now been referred to the Soil Protection Division for further action.

(ii) The stabilisation of sloping lands in the Old Koringberg soil conservation area

During the year under review 513 ha of lands were protected by means of contour systems.

(iii) Stabilisation of wind-eroded lands in the Hopefield and Vredenburg soil conservation areas

The remaining 100 ha of blown dunes was fenced in this year, bringing the total area of blown dunes fenced and withdrawn from grazing to 850 ha. Wind-eroded patches on lands and vulnerable lands were identified.

(iv) Reclamation of brackish areas in the Moorreesburg and Hopefield soil conservation areas

This year 172 ha (24,1 %) of the 714 ha of brackish land was established under old-man saltbush. This brings the total since the start to 413 ha (57,8 %). Good progress was again made, and many farmers not involved in the project have started to reclaim brackish lands in this way themselves.

(v) Record-keeping and the identification of problems in the dairy industry in the Koeberg-Durbanville area

This project was carried out as planned and farming records are kept by eight collaborators. Valuable economic production data are also being collected, which will make a big contribution to optimum land use.

(vi) Veld reclamation: Ceres-Karoo

Plant surveys were continued on nine farms. As a result of good rains and stock reduction, the composition and plant cover have improved considerably. Radical veld improvement was started by the seeding of 10 ha of veld with a poor plant composition. A successful farmers' day was held and was attended by 30 farmers. The project is being continued.

(vii) Mail-in records for the warm Bokkeveld (Ceres)

The membership of the study group increased by five during the year. Much useful information on management and economic norms is being obtained. A successful two-day course on mechanisation planning was presented for 14 members of the group. A group discussion on the important problem of pest control costs was organised.

(viii) Record-keeping and the identification of problems in the wine grape industry in the district of Worcester (Mail-in Records Study Group)

The 18 members of the group show great enthusiasm. Valuable information was obtained from the analysis results of the first year. The results were explained to each member during individual visits and one communal meeting was held to determine the establishment cost of wine grapes.

(ix) Drainage evaluation programme in the Boland Subregion

In view of the tremendous number of applications for drainage subsidies received (R113 555 provisionally approved) in the Subregion, it was considered essential to evaluate the effectiveness of the work. Accordingly 23 drainage systems were selected throughout the Subregion for evaluation of the works. Technicians also received training on effective drainage during a short course. An agreement was entered into with a co-operative to supply material to carry out the project free of charge.

(x) The utilisation of waterlogged and brackish soil for agricultural purposes by means of physical planning (Stellenbosch)

This valuable project is making satisfactory progress and the target of 50 ha per year was exceeded by far in that 104 ha of drainage systems was designed and completed, while on another 55 ha of waterlogged soil, drainage systems were designed but have not yet been completed. Since the project was started three years ago a total of 359 ha of waterlogged soil has already been drained and made usable for permanent crops.

(xi) A study of viticultural practices in the Stellenbosch extension ward based on the resources available

Excellent progress has been made with this very comprehensive project, which consists of the following sections:

- Establishment of yield norms according to the soil type
- Long-term planning of farms according to soil potential (production unit planning)
- Improvement of short-term techniques
- Advice on soil preparation

Yield norms

With the inclusion of wine quality - which is difficult to judge and varies considerably from year to year - the project would appear to have expanded to such an extent that it has started to exceed the reasonable limits of an extension project. The yields from numerous blocks have to be noted. Although big differences occur, the yield levels of various cultivars on comparable blocks are nevertheless illuminating.

Long-term planning

During the year 12 farms were dealt with according to the production unit planning technique. This area of 1 217 ha brings the total for the ward to 29 farms with a joint size of 6 487 ha.

Advice on soil preparation

The procedure followed is that farmers are required to give timeous notice of their intention to re-establish a part of an orchard or a vineyard. The soil is classified and analysed beforehand and a recommendation is then made in respect of chemical and physical corrections. During the past year 405 ha was completed on 41 farms, which brings the total for the past three years to 1 126 ha.

Short-term techniques

Significant changes in practices took place as a result of 30 group discussions and 24 demonstrations organised for the six study groups. In 1969, for instance, only 20 per cent of farmers used chemical weedkillers and in 1977/78 the total had already risen to 68 %. An average of 87 % of members of wineries were reached with information concerning nine short-term techniques.

(xii) Erosion control in the Wellington extension ward

Partly as a result of the change in the tariff structure for erosion works, but mainly as a result of the enthusiasm and devotion of the officer concerned, this project suddenly gained momentum and 554 km of contour banks was designed and built to protect 2014 ha - an exceptional achievement. The progress made with neglected waterways was equally satisfactory and of the 14

waterways designed 11, extending over 3 887 metres, were built.

Biological control of erosion is also progressing satisfactorily and approximately 2 000 ha of grass clover pastures was established during the year under review in crop rotation with wheat, which brings the total for the past three years to 3 200 ha. The present dry season is, however, expected to stem this favourable development.

SOUTH-WEST AFRICA REGION

The soil conservation committees act as programme planning committees in collaboration with the farmers' associations and the members receive informal training in the form of lectures during committee meetings.

Every year the soil conservation committees draw up an annual programme and an annual report which are submitted to the Regional Advisory Committee. The programmes are based mainly on the improvement of grazing, which is regarded as the most important natural resource of the Region.

KAROO REGION

The progress made with a few programmes is mentioned below.

- (a) Introductory programmes in connection with nassella tussock *Stipa trichotoma*
- (i) The primary aim of the programme is to make farmers and their labourers aware of the dangers of the weed and to make them familiar with it.
 - (ii) In the Karoo Midlands Subregion eight articles were published in local newspapers with a circulation of 3 500 and a pamphlet was distributed to 948 farmers. The chairmen of soil conservation committees or nassella tussock control committees in the Graaff-Reinet and Somerset East extension wards posted letters to 289 landowners on whose farms the weed occurs. Lectures were given to eight soil conservation committees (attendance of 73), nine farmers' associations (attendance of 173) and one study group with an attendance of 13.
 - (iii) A survey among 43 farmers in the Somerset East extension ward showed that:
 - 77% of farmers are able to identify the grass
 - 46% of the labourers are able to identify the grass
 - nassella tussock occurs on 38 farms and the infestation covers an area of 25 879 ha, out of a total of 88 782 ha.
 - 64% of the owners are able to eradicate the weed without physical assistance, provided that weedkiller is sold at a reduced price.

- (b) Communication programme to increase farmers' knowledge of irrigation farming

The programme has been conducted in the Fish River Valley (Cradock and Somerset East)

since 1976. During the year under review the following steps were taken:

- A farmers' day on mechanisation planning was held, and 30 farmers attended.
- Three-hour meetings on "Cotton planting", "Maize and sweetcorn cultivation" and "Durum wheat cultivation" were held; the total attendance was 116.
- Talks were held with 10 officials from co-operatives on cultivation and fertilising practices.

EASTERN CAPE REGION

(a) Catchment planning programme

This programme is applicable to the following areas in the Aliwal North extension ward:

Bossieslaagte, Melkspruit, Oslaagte, Klipspruit/Elandslaagte and Telemachus/Skulpsspruit.

In the last-named area the investigations on soil, vegetation and hydrography were completed. Reports in respect of soil and vegetation have already been drawn up, and the report on the hydrography is being completed.

During the year, four State works were completed, namely three in the Oslaagte catchment and one in the Bossieslaagte catchment. A major farmers' work is still under construction in the latter area.

(b) Red meat production programme

The object of the programme in the Aliwal North extension ward is to increase red meat production among members of the Red Meat Club over a period of five years from 8,5 kilograms per hectare in 1974 to 13,5 kilograms dressed mass per ha in 1979. It is anticipated that, as a result of the influence of these leading farmers, production will show a general increase from 5,8 kilograms to 9,8 kilograms per ha over a period of ten years.

This programme is carried out in close co-operation with Organised Agriculture and only full members of Organised Agriculture are admitted to the Club.

The extension inputs in the programme were an individual analysis of each collaborator's farming operation, one farmers' day, four lectures to study groups and about 35 visits to farmers. The cattle and sheep breeding groups have now been functioning very efficiently for more than a year with the aid of performance testing, and it is expected that the object will be realised within the said period. Table 1 shows progress to date.

(c) Completed liaison programmes

Although final reports have been submitted and projects have been officially ended, certain facets of completed programmes are being continued owing to their importance on the overall extension effort. The advantages of this are shown by criteria such as histograms reflecting progress in respect of liaison projects OK-VL 13/1, 13/2 and 13/3 in the Aliwal North extension ward.

TABLE 1 - Progress with the production of red meat in kilograms of dressed mass per hectare per year on farms of red meat club members in the Aliwal North Extension ward, 1973-1978

Year	Kilograms of dressed mass per hectare per year
1973/74	8,5
1974/75	9,4
1975/76	14,2
1976/77	12,1
1977/78	12,3
Object	13,5

ORANGE FREE STATE REGION

(a) Production techniques and yield norm study

This study furthers the departmental policy of optimum land use and also forms the hub of agricultural extension in the Free State Region. Experience during the past year again showed that the study makes a big contribution to the development of extension officers into experts on the area and industry and the consequent enhancement of the reputation of the Departmental extension service.

- The primary object of the study is to:
- (i) outline homogeneous farming areas on the basis of identified land types;
 - (ii) determine, by means of case studies among selected collaborators in the homogeneous farming areas, the yield norms and accompanying production techniques of the most important farming enterprises;
 - (iii) establish directives for adapted farming systems in each of the homogeneous farming areas; and
 - (iv) convey the information acquired to producers in a judicious manner.

Table 2 (next page) is a summary of extension inputs with regard to the production techniques and yield norm studies in the Region.

The following is a concise discussion of the statistical return with regard to this key programme for the year under review.

- (i) Out of a total of 22 extension ward offices, 16 had extension officers on the staff. Some extension officers serve two extension wards and some of the chief extension officers serve vacant wards.
- (ii) According to a survey carried out by the Soil and Irrigation Research Institute, 123 different land types were identified and mapped in the Free State Region. These land types serve as a basis for outlining homogeneous farming areas. The demarcation of these areas has not yet been completed in all the subregions, but to date 61 homogeneous farming areas have been demarcated.
- (iii) Case studies were undertaken with a total number of 311 collaborators. In the selection of collaborators a special effort is made to select those collaborators from whom reliable

information and good co-operation can be obtained.

- (iv) Only the most important farming enterprises in the Region are involved in the study, as is shown in the table.
- (v) In all 486 studies were undertaken at the farms of the 311 collaborators and 1305 measurements were taken during farm visits. The results, and information resulting from these measurements, were discussed with farmers during 138 gatherings such as soil conservation committee meetings, study group meetings, farmers' association meetings and small demonstration groups.
- (vi) *Findings:* Extension officers made contact with and had access to the leading farmers and their farming practices. Armed with information gathered in a reliable and scientific way, it was possible to identify yield levels and related production techniques in each homogeneous farming area. A few interesting conclusions are given below.

(b) Maize

- (i) In the Christiana extension ward it was found that, on a Hutton soil form with an effective depth of 1,5 metres, maize yields increased in proportion to the plant stand as shown below:

Plant stand/ha	Yield	
	kg	90 kg bags
10 000 and less	562	6
11 000 - 15 000	1 285	14
16 000 and more	2 019	22

At this stage it is accepted that a plant stand of 11 500 plants per hectare should not be exceeded. Continued observations in this respect are important.

In respect of nitrogen fertilising it was found that an application of 15 kg of N and less produces a yield of 872 kg/ha (9,6 x 90 kg bags) as against 2 646 kg/ha (29 x 90 kg bags) where maize received more than 15 kg of N/ha.

- (ii) Irrigated maize at Vaalharts and the effect of fertilising, plant stand and irrigation on maize yields are shown in the following table.

Practices	Average yield 5 780 kg/ha	Maximum yield 7 823 kg/ha
Cultivar	SSM 222	SSM 222
Planting date	30 Nov. - 17 Dec.	23 Nov. - 6 Dec.
Spacing	0,900 x 0,180 m	0,800 x 0,150 m
Plants/ha	34 000	51 000
<i>Fertilising</i>		
N	120	168
P	30	42
K	30	42
Number of irrigations	3	7

TABLE 2 - PRODUCTION TECHNIQUES AND YIELD NORM STUDY FOR 1977/78, FREE STATE REGION

WARDS/SUBREGIONS	1 Bechuana- land	2 Griqualand West	3 Gordonia	4 Central-OFS	5 South-western OFS	6 South-eastern OFS	Total for the Region
Resources identified							
(i) Number of land types							123
(ii) Number of reasonably homogeneous farming areas		20	4	20	17		61
Number of collaborators ¹	25	64	12	80	62	68	311
Number of (a) studies**							
(b) measurements***	a b c	a b c	a b c	a b c	a b c	a b c	a b c
(c) gatherings**** in respect of:							
(i) Large stock	12 20 0		2 50 0		1 5 0		15 75 0
(ii) Small stock	4 28 0	4 8 1	1 4 0	30 116 19	35 158 0	30 79 8	104 393 28
(iii) Winter cereals and forage crops		21 60 3		41 63 30	29 106 2	49 55 12	140 284 47
(iv) Summer cereals and forage crops	15 30 7	71 188 5		48 80 33	14 89 1	37 54 4	185 441 50
(v) Horticultural crops		9 37 2					9 37 2
(vi) Vineyards					8 18 5		8 18 5
(vii) Veld				5 5 3			5 5 3
(viii) Other		16 41 3			1 5 0		17 46 3
Tobacco		3 6 0					3 6 0
TOTAL							486 1305 138

1) *The number of *collaborators* is the number of farmers on whose farms studies were made during the year under review

a) **The number of *studies* is the number of enterprises studied and on which separate record were kept for the processing of data

b) ***The number of *measurements* is the number of occasions on which verified information in respect of each separate study was gathered, regardless of the extent of the information gathered

c) ****The number of *gatherings* is the number of organised rallies of groups of farmers (two or more) with whom data gathered were discussed

(c) Wheat

- (i) In the Central Free State Subregion it was found that dryland wheat, planted after a short fallow period following a summer crop such as maize or grain sorghum, produces up to 80 % higher yields than when wheat follows wheat directly.
- (ii) Similar findings were made in the Wepener ward in the South-Eastern Free State Subregion where the wheat cultivar Scheepers 69, on a Sterkspruit Series, with all other factors constant, produced a yield of 2,80 tons per hectare after a fallow period of 10 months, as against 1,55 tons per hectare on the land where wheat was cultivated on wheat (4 months' fallow period). Similar findings were obtained at Zastron. From these controlled observations over a reasonably short period it would appear that a wheat cultivation programme that includes a long fallow period can be recommended in future.
- (iii) In the Petrusburg ward information on dryland wheat cultivation has been collected over the past four years and the following trends can be observed:
 - The best planting date is between 10 and 15 April.
 - The best cultivar is Scheepers 69.
 - Phosphate fertilising is increasing by the year, while nitrogen fertilising is decreasing.
 - In general, grazing reduces the wheat yield.
 - A better yield appears to be obtained where at least one deeper cultivation is applied.
 - Soils of the Hutton form with a clay content of 14 - 18 % give the best yields.
- (iv) As regards wheat under irrigation at Vaalharts, the results of five collaborators during the past three seasons revealed the following:

Cultivar	Planting time	Yield/ha	
		kg	90 kg bags
T4	9 June - 14 July	4 698	52
Inia	24 June - 28 June	3 099	34,4
Zambezi	9 June - 19 June	3 774	42

In spite of the fact that T4 was planted as late as 14 July it nevertheless yielded better than Inia and Zambezi.

Although research results indicate that 120 kg of N is an economic level of fertilising on Hutton soils, the collaborators apply 130-150 kg of N/ha.

(d) Groundnuts (Irrigation)

The effect of cultural practices on the yield of groundnuts: Vaalharts 1976/77:

Practices	Lowest yield	Highest yield
	2,350 tons/ha	3,970 tons/ha
Cultivar	G280	G280
Planting date	10 Nov.	7 Oct.
Number of irrigations	6	9
Leaf spot treatment	3	3
Number of days, planting to lifting	124	150

Provided the plants remain healthy and vigorous, the number of days from planting to harvesting is of fundamental importance. The production techniques and yield norms studies have clearly proved that producers should keep groundnuts in the ground for at least 150 days to ensure a good yield. Similar norm studies are being carried out and equally informative results are being obtained with cotton, factory tomatoes and potatoes.

The results of the production techniques and yield norm studies are considered very valuable by farmers and agriculturists attached to co-operatives. One of the soil conservation committee members in the Griqualand West Subregion recently remarked that in the 20 years of his association with the committee this is the most positive step that has yet been taken by the extension staff of the Department.

HIGHVELD REGION

The main task of Agricultural Extension is to impart existing knowledge to farmers and persuade them to apply new practices. Data concerning the characteristics of the most important croplands of the Region and applicable production norms have not, however, been available. Before communication programmes could be started, Agricultural Extension was obliged to acquire the missing data in 22 development areas. This was a most comprehensive and time-consuming task. Fortunately nearly all the projects have been completed and the final reports are being prepared. From 1977/78 onwards, therefore, it has been possible to use the available manpower for communication programmes.

Although the programmes have not been in operation for long, encouraging results are already being obtained. A few of the successes reported are given below:

- (a) In the Vermaas Development Area (District of Lichtenburg) a yield increase of nearly 67 % was obtained with maize (2 200 kg/ha as against 3 665 kg/ha) where lands were fertilised according to potential. With sunflowers even better results were obtained, namely a yield increase of 103 % (705 kg/ha as against 1 430 kg/ha).
- (b) In the Argent Development Area (District of Delmas) 73 % of the collaborators had started regrouping lands according to potential by January 1978, as against only 9 % during April 1977, when the programme was started.
- (c) In the vicinity of Lusthof-Zoetmelkvlei (District of Lichtenburg) an ambitious run-off

control project was planned. In a catchment of 28 000 ha, involving 40 farmers, 80 kilometres of water waterways were designed. Of these, 60 kilometres have already been built, 40 kilometres have been subsidised while the remaining 20 kilometres of waterways will be built next year.

The project proved its value during the heavy rains of the past season in so far as only minimal waterlogging was experienced.

(d) Extension officers are at present re-designing their communication programmes, mainly to incorporate the following aims:

- (i) The farm as a whole should systematically be placed on a sound footing. This implies that the farmer should have a thorough knowledge of the resources he is exploiting, to enable him to get to the root of his problems.
- (ii) Farmers should therefore be trained in soil science to the point where they are able to classify their own soils, regroup their lands and fertilise them according to potential. This will help the farmer to take sensible decisions independently.
- (iii) Not only the progressive farmer but also the average farmer should be involved in extension programmes.
- (iv) Communication programmes should extend beyond the limits of development areas. Areas that are reasonably homogeneous in respect of development areas should be demarcated and programmes conducted inside these boundaries.

TRANSVAAL REGION

In spite of obstacles it was nevertheless possible to start a number of projects. As a result of the time-consuming processes used to gather information, these projects have brought about few changes in farming practices. It is to be hoped that these attempts will become more successful during the next few years - as soon as meaningful extension can be brought to the farmers.

The progress made with the various projects can be summed up as follows:

(a) THE DEVELOPMENT OF ADAPTED FARMING SYSTEMS FOR THE EERSTEGOU TARGET AREA

The final report is being completed at present. The land use pattern, economic situation and willingness to introduce new farming practices have already been determined and described. The response has been disappointing.

(b) THE DEVELOPMENT OF A RUN-OFF CONTROL SYSTEM FOR THE GROOT OLIFANTS TARGET AREA

Overall run-off control planning has been completed and the final report submitted. It was

found that 6 539 ha of land will have to be protected against erosion. To do this, 142 km of waterways and 1 572 km of contours will be necessary.

Approximately 64 per cent of the target area consists of cropland with a medium to high field husbandry potential.

(c) THE DESIGN OF A RUN-OFF CONTROL SYSTEM FOR THE VLOOIKOP TARGET AREA

Good progress was made with the gathering of the data. A questionnaire still has to be completed to conclude the project. A start has already been made with the dissemination of information and the design of conservation structures. The soil classification of the area has been completed.

(d) A COMMUNICATION PROGRAMME FOR THE PROMOTION OF EFFECTIVE VELD AND STOCK MANAGEMENT PRACTICES IN THE THABAZIMBI BUSHVELD

During the first phases of the project farmers' knowledge of pasture science was refreshed and they were instructed on how to put this knowledge to better use. During the past year the emphasis was mainly on stock farming management. The media used for this purpose were the newsletter, an exhibit at a show, a farmers' readingroom, grazing study groups, an economic study group, a grazing short course and a management calendar for extensive cattle farming.

(e) THE COMMUNICATION OF IMPROVED STOCK FARMING PRACTICES IN THE KOEDOESRAND TARGET AREA

An evaluation was made with the aid of a mail-in questionnaire during the past year. It would appear from this that farmers who attend the meetings regularly have a better insight into the principles of grazing management than those who attend meetings irregularly. The poor general prospects of cattle farming hamper the progress of the project.

(f) A COMMUNICATION PROGRAMME TO PROMOTE IMPROVED VELD AND STOCK MANAGEMENT PRACTICES IN THE ELLISRAS EXTENSION WARD

During the first phases of this programme farmers' knowledge was supplemented with regard to the plant composition of the pastures, the physiology and nutritional value of grasses and the basic principles of utilisation. An attempt was made during the past year to persuade farmers to follow adapted crop production systems. Progress was, however, hampered by the current marketing crisis. Media that were used included slide shows, soil conservation committee meetings, study groups, newsletters, and a farmers' tour.

(g) THE DEVELOPMENT OF ADAPTED FARMING SYSTEMS FOR THE KAFFERSPRUIT TARGET AREA

The final report on this project has been submitted. It appears that 49 % of the area is under dryland crop cultivation, with maize, potatoes, dry beans and sunflowers the most important cash crops. Approximately 78 % of the farmers rest less than 20 % of their grazing for the full growing season each year. Avalon and Hutton are the most important soil forms in the area and it is estimated that 26 % of the croplands have a high, 39 % a medium and 35 % a low field husbandry potential.

(h) EFFECTIVE RUN-OFF CONTROL PLANNING FOR THE KAFFERSPRUIT TARGET AREA

About 31 % of the artificial waterways has been surveyed and designed and 21 % has been built and established under grass. So far it has been possible to survey only 1,5 % of the required contour banks.

(i) THE DEVELOPMENT OF A RUN-OFF CONTROL SYSTEM FOR THE KENDAL AREA

Good progress was made with the replanning of run-off control systems. Forty waterways were established under grass and 30 km of parallel contours were surveyed and built.

(j) THE DEVELOPMENT OF AN ADAPTED FARMING SYSTEM FOR THE GROOT OLIFANTS TARGET AREA

The soil classification was completed and the soil map drawn. High-potential soil (deeper than 80 cm) takes up 5 762 ha (45 %) of the area. Medium-potential soil (40 to 70 cm) takes up 2 353 ha. The connection between soil classes, yield potential and estimated gross margin was tabulated for maize, grain sorghum, sunflowers, kidney beans, sugar beans and potatoes. The final report is nearing completion.

(k) THE DESIGN OF A RUN-OFF CONTROL SYSTEM FOR THE KLEIN KOMATIE TARGET AREA

The overall run-off control planning was completed during the year and tested in the field. As soon as a maintenance schedule has been completed and the data processed it will be possible to register a communication project.

General

- An Agronomy Advisors' Study Group (NAAS) was established in the Northern Transvaal during the past year. The aim of this study group is to gather and interpret information on field husbandry, to make it possible for all the bodies concerned with extension to follow a uniform policy. The

members of this study group come from various sectors involved in extension in the Northern Transvaal.

- A project aimed at making cattle farming in Nylstroom more efficient and a field husbandry project for the Alma target area were submitted.
- Trials for the control of silverleaf bitter apple *Solanum elaeagnifolium* are being carried out in wheat lands on the Springbok Flats and various weedkillers are being tested.
- A course in farm management presented in the Nelspruit and Lydenburg extension wards was attended by 30 farmers and will be followed by a more advanced course at a later stage.
- A two-day symposium on avocado cultivation was presented during November in Tzaneen in collaboration with the SA Avocado Growers' Association.
- An investigation was undertaken at Hoedspruit to determine the extent of the brack problem and the waterlogging of irrigated land. A questionnaire was completed and soil samples were taken on the farms of 15 farmers in the area.
- In the maize competition held in the Middelburg extension ward, four farmers obtained more than 100 bags per hectare. The winner obtained 112 bags per hectare on a Hutton soil (35 % clay and 120 cm deep) with a rainfall of 622 mm. In all, 22 entries were received. The competition is linked to a show, serves as a means of bringing farmers together and is a good extension medium.

NATAL REGION

Good progress was made with various programmes during the year under review. The most important results are discussed briefly.

- (a) A programme to improve the cattle farming practices of 15 cattle farmers in the Melmoth soil conservation district showed good progress.

With the aid of the Beef Study Group of Melmoth, the importance of correct mineral supplementation for cattle to increase the calving percentage was emphasised. About 40 liver and 270 blood analyses were carried out with the aid of the Veterinary Division of Allerton, to establish trace element deficiencies. Tests were done to determine calcium, phosphate, magnesium, copper, zinc, iron, potassium, cobalt and manganese deficiencies. Preliminary findings include the following:

- The results seem to indicate that magnesium and phosphate are low in the higher lying parts of Melmoth, but not in the lower lying areas.
- It was also found that the number of hectares of grazing per large stock unit is directly correlated with the calving

percentage. Where the stocking rate is high, the calving percentage as well as the weaning mass, the mass of cull cows and the growth rate of replacement heifers is low.

- Where farmers maintained a stocking rate of 5 ha/LSU the calving percentage was 45 % as against the 70 % obtained by farmers with a stocking rate of 6,5 ha/LSU.
- (b) The goal of the programme for the economic intensification of beef production in the Swartberg part of Griqualand East had to be modified somewhat. The emphasis shifted from increased beef production to the reduction of feed costs, as a result of the poor economic climate for beef production.

The final stage of the programme consisted of individual extension to seven collaborators. The following activities received attention:

- A questionnaire in respect of information concerning farms and beef production systems was completed.
- Livestock requirements were calculated and feed budgets drawn up.
- Soil samples were taken and the necessary fertilising recommendations made.
- The winter feed position was determined during autumn and recommendations on supplementation made.

- (c) A programme for the promotion of maize yields among maize farmers in the Greytown Extension Ward, based on research on the factors limiting maize production, again gave good results during the past year and was exceptionally effective.

A comparison between the figures for the years 1976 to 1978 and those for the 1974/75 seasons, when the programme was started, revealed the following progress in respect of limiting factors:

- The percentage of farmers who had a plant stand of under 30 000 decreased from 51 % to 6 %
- The percentage of farmers with under 10 % gaps in stands increased from 21 % to 80 %.
- The percentage of farmers who carry out routine cutworm control increased from 58 % to 95 %.
- The percentage of farmers who carry out weed control with hormone weedkillers in some form or another increased from 70 % to 94 %.
- The percentage of farmers who obtained satisfactory weed control increased from 40 % to 79 %.
- The percentage of farmers who prepared a fine seed bed increased from 46 % to 74 %.
- The percentage of farmers who insure minimum plant residues during planting time increased from 46 % to 84 %.

STUDY GROUPS AND PLANNING COMMITTEES

SOUTH-WEST AFRICA REGION

Three new study groups were established during the year under review. This brings the total to 25. The most important subjects are economics, grazing control, the determination of meat production per hectare, licks and lick intakes and improved field husbandry practices. Information on results and progress is passed on to farmers during gatherings. When possible, the newsletter of the ward is also used for this purpose.

KAROO REGION

- In all, there are 36 study groups in the Karoo Region, with a membership of 287. Thirty-four of the 36 study groups had as one of their objects the economic planning and management of farming operations.

Other study subjects are the improvement of grazing, cultivation of drought-resistant feed crops, treatments before and after fires, the reclamation of bare patches and effective herd management.

- In the course of their work the 36 study groups held 91 meetings or gatherings. Their activities included a very successful symposium on drought feeding, which was held at Calvinia, with an attendance of 106.

A few illuminating findings are briefly discussed below.

- The study group at Richmond has found that the farmer who allows a larger area per small stock unit earns up to R4,87 more per sheep than the farmer who allows a smaller area, mainly because the latter has to provide extra feed. The study group at Middelburg found this difference to be R2,57 per sheep.
- The study groups at Carnavon, Amandelboom and Kareevlak, with a total membership of 25, had a good year and their economic analyses show the following:

		Fine wool*	Mutton wool*	Mutton*
Capital income	(R)	9,14	14,79	20,09
Product income	(R)	8,17	3,86	0,94
Total		17,31	18,65	21,03
Directly allocable costs		2,88	2,64	3,22
Gross margin		14,43	16,01	17,82
Lambing percentage	%	88,5	94,8	115,2
Weaning percentage	%	87,6	94,1	93,5
Ewes in herd	%	67,5	65,9	72,6

* Information given per small stock unit

After the analysis records had been received, each farming unit was diagnosed and a budget drawn up for the following year.



The Cedara College of Agriculture commemorated its 75th birthday in 1978. One of the functions held during the commemoration was an open farmers' day. This photograph was taken during a visit to the sheep section at the College

EASTERN CAPE REGION

The following table shows the situation concerning study groups in the Eastern Cape Region.

Study groups of the Eastern Cape Region, according to extension wards (1977/78)

Extension Ward	Study groups		
	Number	Member-ship	Number of meetings
Adelaide	1	18	6
Alexandria	4	71	25
Aliwal North	2	32	18
Barkly East	2	32	10
Dordrecht	1	8	4
Elliot	2	6	1
Grahamstown	3	51	20
Humansdorp	2	18	13
Molteno	2	20	2
East London	1	16	4
Queenstown	2	29	22
Stutterheim	1	18	5
Uitenhage	1	8	2
Total	24	327	132

The majority of the study group members also participate in the mail-in records system of the Department of Agricultural Economics.

Analysis sheets frequently reveal problems that could be solved by the application of improved farming practices. For instance, the economic analysis of the Winterberg study group in the Queenstown extension ward indicated a problem in their beef enterprise. Extension officers were able

to determine that the main cause was poor adaptation of the animals. A breeders' group was formed and each member sent the six most highly productive female animals from his herd to a central herd.

This central herd is kept under constant environmental conditions and performance testing takes place to identify the best producers. The central herd was selected from various herds, comprising more than a thousand cattle in all. Each member of the group also participates in the performance testing scheme of the Department and can therefore supply two heifers that give the best performance to the group each year.

The possibilities of breeding cattle best adapted to the environment as well as bulls from the central herd for members are therefore very good.

Other useful figures produced by similar analyses include those of the Onderkraai study group in the Aliwal North Extension Ward, which obtained an average of R9 interest per R100 capital investment as against the 1976/77 figure of R11,21. The results also showed that an average of 37,07 % of all expenditure consisted of toolage costs, 20,19 % consisted of labour costs and 10,94 % of purchased feed and licks.

The activities of the study groups and their members will in future make a big contribution to the establishment of production standards according to particular production techniques. This data will be of considerable value in realising the aim of optimum land use in the Region.

FREE STATE REGION

At present there are 43 study groups with a membership of 369 in the Free State Region. During the year 157 meetings were held. A wide variety of subjects are dealt with by the study group.

In the Free State Region, soil conservation committees serve as *programme planning committees* and these committees play an active part in extension activities. Thirty-seven committees with a membership of 302 function as such. The programmes dealt with by the committees cover a wide variety of subjects, a few of which are mentioned below to illustrate the range of these programmes.

- Production techniques and yield norm studies
- The identification of brackish irrigation land and the determination of the extent of this problem along the Lower Orange River
- The persuasion of irrigation farmers to drain waterlogged lands and particularly brackish soils
- The promotion of sound viticultural practices
- The planning, organisation and active participation in panel and group discussions based on enterprises with problems.

Good progress was made during the past year with the implementation of the extension programmes. A few examples are given below.

- (a) In the District of *Rouxville* the committee was actively involved right from the beginning, in the programme for promoting the implementation of proposed farm planning in the Nuwejaarspruit subcatchment. The object of this programme was to erect all proposed fences and establish stock-watering systems, contour bank systems and waterways within five years of 1 July 1974, to fence in and suitably withdraw from grazing the areas affected by the 12 State works and to plant common reed, where possible, to promote the biological recovery of the areas affected by State works. The results obtained during the year under review and in the past four years are given below (Table 3).
- (b) The Viticultural Liaison Committee of *Vaalharts* launched a programme to identify the problems in this young industry and to take steps to ensure the viability of the wine industry in the area in which considerable capital has already been invested. The first step was to carry out a survey on the nature and extent of the industry, according to the

area under vineyards, the number of vines, the different cultivars and their vigour, training systems and disease control.

Various demonstrations, personal visits to give advice and monthly newsletters were part of the programme of action; the co-operation of the co-operative was also obtained.

The poor vigour of some important cultivars, which were planted as ungrafted vines, was identified as one of the most important problems. Following the programme of action -

- the Vaalharts Agricultural Co-operative was persuaded to order rootstocks and grafted vines that had been suitably treated against phylloxera from the Western Cape (in all, 121 000 stocks were obtained and were used for interplantings by 28 farmers);
- a co-operative nursery was planned and prepared for the planting of the first material during the spring of 1978;
- the local co-operative was persuaded to make long-term credit available to prospective producers for the construction of trellising systems; and
- a considerable improvement in the cultivation of vineyards and the managerial ability of entrepreneurs was brought about and dividends in the form of increasing yields (as much as double those of the previous year) were obtained.

HIGHVELD REGION

The demands made on extension officers by programme planning compels officers to make less use of individual visits and contacts as extension media and to concentrate on group and mass media. This Region attaches much value to study groups as a channel of communication and a means of conveying knowledge and persuading farmers to accept new practices. It is therefore foreseen that in the near future a considerable number of new study groups will be established as an integral part of the extension programmes.

During the year under review 23 study groups with a total membership of 480 were active in the Region. These study groups held 112 meetings.

Subjects of study were of a diverse nature and included the following: economic planning of farming operations; correct selection of cultivars and planting dates; pasture improvement and

TABLE 3

Nature of the work	Works proposed	1977/78 Constructed	Total completed
Internal camp fences	90,9 km	17,70 km (40,4 %)	64,82 km (71,3 %)
Waterway fences	260,5 km	17,67 km (13,7 %)	148,83 km (57,1 %)
Erosion fences	182,5 km	6,11 km (10,1 %)	128,05 km (70,2 %)
Total fences	533,9 km	41,48 km (17,8 %)	341,70 km (64,0 %)
Stock-watering systems	90	20 (35,7 %)	54 (60,0 %)
Contour banks	25,7 km	4,5 km (28,7 %)	14,5 km (56,4 %)
Waterways	17	-	17 (100 %)
State works fenced in	12	1	12 (100 %)

* The works constructed during the year under review were calculated as a percentage of the works not yet completed on 1977-07-01.

utilisation; increasing the efficiency of milk production; crop selection according to soil potential; withdrawal of low-potential soils from crop production; and soil classification.

SMALL GRAIN CENTRE IN THE HIGHVELD REGION

Industrial extension activities

The most important task carried out by the industrial extension officer was liaison with 65 Departmental and 53 private agricultural advisers in the various small grain regions of the Republic. The results of elite and cultivar trials, summaries of proceedings at symposia and other general technical literature were posted to these advisers.

Farmers' days and other meetings

Ten farmers' days during which officials of the Centre acted as speakers were held. The average attendance was 41 producers per farmers' day.

In addition to farmers' days, officials addressed eight other meetings (farmers' associations, study groups) with an average attendance of 26. On all these occasions roneoed lectures were distributed among those present.

A symposium of fertilising, attended by 88 researchers and agricultural advisers, was organised by the Centre. A summary of the papers read at the symposium will be sent to all agricultural advisers and other interested persons during the coming year.

Ten farmers' days, at which responsible groundnut researchers and other officials participated, were also held. The average attendance was 27 producers per farmers' day.

Radio talks and pamphlets

A series of radio talks (12 instalments) was broadcast from mid-October to the beginning of

November. It dealt with various aspects of groundnut cultivation. A number of pamphlets were compiled from this series and are being printed.

NATAL REGION

The 17 study groups of the Natal Region with a membership of 219 held 56 meetings or gatherings during the past year.

The following were a few of the activities of the study groups during the past year:

- The Alfred Beef Study Group was highly successful during the past year, with increased growth and calving percentages which can be attributed mainly to their supplementation programme. The most important measure applied was the supplementation of phosphate with poultry manure.
- The three soil conservation committees at Winterton, Weenen and Greytown act as programme planning committees in the Natal Midlands and are as such actively involved in the registered projects of the Region. The committee at Winterton laid out maize demonstration sites. The committee at Weenen assisted in the planning of farms in the programme areas and also lent a hand with inspections and the evaluation of progress.

The Greytown soil conservation committee was again responsible for the evaluation of accepted improved maize practices in the programme.

- The soil conservation committees at Greytown, Camperdown, Lions River and Mooi River function as agricultural production committees and each of them operates according to a set programme aimed at improved agricultural production. Accordingly, the committee at Camperdown



Mr H. Matzger of Omantumba, Okahandja, is the 25th farmer to be named a Master Conservation Farmer in South West Africa. The customary farmers' day held at the winner's farm was attended by a great number of farmers

paid advisory visits to five farms. Lions River and Mooi River organised as series of mini farmers' days and short courses. Subjects that received attention were: veld management, feed flow planning for dairy animals, low-cost winter feed for beef cattle and maize production techniques.

SUMMARY OF ACTIVITIES

A summary of the activities of the extension staff of the regional organisations is given in Table 1.

TABLE 1 - Scope of extension activities of the regional organisations

Activity	Number/Length
Survey visits	20 593
Inspection visits	13 548
Extension visits	15 940
Interviews	120 258
Group contact and activities	
Number of study groups	246
Total membership	5 851
Number of study group meetings held	918
Number of subjects dealt with by study groups	37
Number of programme planning committees	116
Number of participants in competitions	848
Number of competitions held in wards at which Departmental officers acted as judges	70
Farmers' days arranged	343
Courses presented	120
Demonstrations held	314
Regulatory activities	
Properties inspected for weeds	4 124
Notices served under the Weeds Act	1 155
Proceedings instituted	4
Re-inspections after notices	607
Surveys (contour)	13 970 km
Surveys (pipelines)	4 501 km
Surveys (other)	2 640 (works)
Miscellaneous	
Journeys: self	2 822 620 km
Journeys: as passenger	1 062 613 km
Letters written	24 359
Reports written	7 096
Exhibitions attended	311

The professional and technical extension staff has been using a diary system as a management aid for the past two years, as shown in Table 2. Statistics in Table 2 overlap to some extent with those given in Table 1. The activities shown in Table 2 are known as key tasks and are supplementary to those shown in Table 1.

TABLE 3 - Student numbers at colleges of agriculture (Numbers in brackets are those for the previous year)

College	Student numbers	
Cedara	117	(127)
Glen	86	(80)
Grootfontein	99	(90)
Potchefstroom	132	(115)
Elsenburg	149	(138)
Neudam	42	(38)
Total	625	(588)

TABLE 4 - Short courses presented by colleges for agriculture

College	Number of courses	Attendance
Cedara	15	241
Glen	21	356
Grootfontein	6	100
Potchefstroom	25)	649)
	9)*	265)*
Stellenbosch-Elsenburg	18	523
Neudam	1	25
Total	95	2 159

* These courses were presented away from the college.

TRAINING

COLLEGES OF AGRICULTURE

Table 3 shows the number of students who took diploma courses at colleges of agriculture.

SHORT COURSES

The staff of colleges of agriculture, in co-operation with other extension staff, offer a

TABLE 2 - Key tasks performed and the percentage of time spent on each by professional and technical extension staff

Key task (Activity)	Professional 1977/78		Technical 1977/78	
	% of time spent	Statistics	% of time spent	Statistics
Journeys: self	14,71	1 287 401 km	12,87	1 535 219
Journeys: as passenger	4,88	460 376 km	4,07	602 237
Survey visits	10,20	7 600	11,04	12 993
Inspection visits	2,73	1 971	9,01	11 577
Extension visits	15,00	11 579	4,01	4 361
Surveys (contour)	0,01	6	2,57	13 964
Surveys (pipelines)	0,05	6	2,82	4 495
Surveys (other)	0,02	3	3,09	2 640
Meetings	16,10	1 445 658 min (24 094 hours)	6,51	896 284 min (14 905 hours)
Interviews	14,01	83 200	11,00	37 058
Letters written	4,48	9 585	3,80	14 774
Reports written	6,21	4,101	3,06	2 995
Design (pipelines)	0,81	76	5,40	3 761
Design (other)	6,48	4 573	16,90	14 133

series of short courses each year. These courses make a great contribution to the development of the farmer, or entrepreneur.

Table 4 gives some indication of the extent of this task.

In the Eastern Cape Region extension inputs by the Döhne Research Station were as follows:

	Animal science	Grazing	Field husbandry	Chemistry	Total
Inquiries by telephone	513	198	302	150	1 162
Inquiries in writing	106	90	68	380	644
Visitors to offices	356	160	86	157	759
Farms visited	42	118	51	-	211
Farmers' days held at institution	10	9	2	-	21
Farmers' days on farms	-	9	11	-	20
Short courses	8	3	4	3	18
Radio talks	9	-	-	-	9
Judging at shows	6	-	-	-	6
Special examinations	6	5	2	-	13
Meetings attended	15	40	35	-	90

publication during the year under review, three more than the previous year. Together with 76 articles carried over from the previous year, 160 articles were therefore dealt with. Ninety-one of these were approved for publication, seven rejected, 15 scratched and 47 are still being considered.

Problems sometimes arise in finding sufficient

AGRICULTURAL
INFORMATION SERVICES
POPULAR PUBLICATIONS

Three hundred and seventy new leaflets with a total impression of 1 336 900 copies were printed and distributed to interested parties throughout the year. One hundred and forty leaflets with a total impression of 203 500 copies were reprinted.

About 55 000 names and addresses of interested farmers and institutions have now been computerised.

One hundred and forty-nine thousand copies of the weekly newsletter, *Agricultural News* were printed and distributed, as well as 48 900 copies of *Agricultural Reports*, 62 825 copies of local newsletters, 78 950 copies of farmers' day lectures, library lists, guides and commentaries for slide series, 43 800 copies of test results on egg-laying tests, the milk reporting scheme and tests of feed blenders, planters, augers, drippers, batch mixers, feed-blending wagons and micro-sprays.

Two editions of the publication on the recommendation and correct use of pesticides and fungicides, one edition of the publication *Agricultural Research*, as well as the departmental annual report were prepared and published. Pamphlets and journals to the value of R33 103 were sold during the year.

The departmental annual report (1976/77), two editions of *Trends in the Agricultural Sector* and four editions of *Agrekon* were prepared for printing on behalf of the Department of Agricultural Economics and Marketing.

SCIENTIFIC PUBLICATIONS
AGROPLANTAE, AGROANIMALIA,
AGROCHEMOPHYSICA,
PHYTOPHYLACTICA

A total of 84 articles was received for

approved articles for some editions, with the result that such numbers cannot be submitted for printing in time. The downward trend in the number of contributions seems to have been stemmed, but not to a sufficient degree.

ONDERSTEPSPOORT JOURNAL OF
VETERINARY RESEARCH

Four editions of this journal, Jg 44(2), 44(3) and 45(1) appeared during the year. A total of 34 contributions was received and, together with 17 articles carried over, 51 were therefore under consideration. Of these, 36 were published, 10 designated for Jg 45(2) and five for Jg 45(3).

OTHER SCIENTIFIC PUBLICATIONS

Other scientific publications appeared as follows:

Flowering Plants of Africa, vol. 44 parts 3 and 4 and vol. 45 parts 1 and 2; *Flora of Southern Africa* vol. 9; *Botanical Survey Memoir* no. 42; *Bothalia* vol. 11 no. 3; Scientific pamphlet no. 390, 392, 393 and 394; Technical Communication no. 128, 134, 135, 136, 137, 138, 139, 140, 141, 143, 144, 145 and 146; *Entomology Memoir* no. 46 and 47.

Twenty-five articles were prepared for printing and publication in the S.A. Forestry Journal for the Department of Forestry.

AUDIO-VISUAL SERVICES

During the year under review 12 synchronised slide programmes were completed. The commentary for 28 programmes was prepared for printing in both languages, while the commentary for 31 programmes was sound-tracked on master tapes and then recorded on cassettes.

The slide series are still increasing in popularity. During the year under review programmes were lent out for 246 events, while 85

programmes were issued on a permanent basis. A large number of non-departmental institutions like schools, universities and Black states bought programmes.

Since the new auditorium at the information centre was taken into use, 470 visitors have attended 38 different programmes. The multi-screen programme on Achievements in Agriculture has been screened 32 times and a duplicated version was also screened at Ermelo.

A two-day meeting was organised for officers from Black states and 46 different programmes screened. The result is that Black states are now also buying programmes.

Assistance was given to several bodies and institutions with the design, preparation and erection of exhibits.

CALLING ALL FARMERS

It remains the constant aim of this programme to reflect the latest scientific thought, to probe future prospects and in every way possible to meet the farmers' requirements. Accordingly, in 1978, appreciable time was allocated for example to the human factor involving, inter alia, an in depth sociological study, rural depopulation especially in the border areas, the nature of development aid rendered to rural Black populations, the training of Black farm workers, the inauguration of a new extension service for Indian farmers, the importance to health of a balanced diet, the work of S.A.N.T.A. among farm populations and the need for heightened safety awareness on farms.

Having regard to pesticides and fungicides, prominence was given to the latest annual guide published by this Department, as also, to the introduction of new chemicals for the control of pests in maize and agents based on synthetic pyrethroids which will greatly improve the farmer's defences against pests in orchards and field crops.

In the light of rocketing production costs, which pose a serious threat to the industry as a whole, much attention was given to planning for energy saving, alternate energy sources, the recycling of animal wastes, the rehabilitation of old equipment, the use of computers to determine optimum stock feeding and fertilizer programmes and to assist in the management of dairy enterprises. Provision was also made for numerous talks on savings which can be effected by following sound economic principles.

The marketing of red meat has been a focal point of interest and this has received correspondingly intensive treatment, involving detailed coverage of the National Marketing Council's investigation into the marketing of slaughter stock and meat, an exhaustive panel discussion concerning the country's "beef bulge" and several progress reports from the Meat Board.

Some of the highlights of the year receiving close coverage were the 75th anniversaries of the Cedara College of Agriculture and of the Botanical Research Institute and the major mechanization field days held at Silverton by the Division of Agricultural Engineering in August on the theme:

Kilowatts for Food.

Reaction elicited by this early morning information programme indicates that farmers and many others appreciate this direct link as it were, with research and development in the agricultural sphere.

AGRICULTURAL NEWS

The need for an official newsletter to reflect agricultural policy and to provide information, has been re-emphasised by the wide use made of the contents of Agricultural News in the media. A random test undertaken in this respect indicated that the rural Press utilises information contained in the newsletter to such an extent that it plays an important part in the distribution of agricultural knowledge to the farmer. Steps are envisaged to improve this service by, inter alia, improving the reproduction quality of photographic material. The redistribution of Agricultural News has once again been expanded on a selective basis.

AGRICULTURAL LIBRARY

Despite the fact that during the past year the membership of the library has increased by approximately eighty members per month, the issues are fewer than those of the previous year. This could be attributed to a number of factors. Farmers are now required to return borrowed books by registered post, whereas in the past, postage was free of charge. Postal losses necessitated this measure. The library now sends fewer books to farmer members, with the accent on more recent and appropriate literature, rather than on the volume of literature sent out. The library now liaises on a far closer level with the Division of Agricultural Information. Many enquiries which can more effectively be disposed of there, are now channelled in that direction.

Every two years members are required to reregister so that the true membership of the library is accurately reflected.

The purpose and functions of the library are being more closely delineated, in collaboration with the library committee. Meanwhile, since important principle decisions have still to be reached in this regard, the internal reorganization of the library is being attended to, while improving its appearance and utilizing the available space to better effect. The periodical collection which comprises approximately 3 000 linear metres has been sorted, duplicates have been removed and the periodicals are now filed in labelled containers. A similar project is envisaged for the Government Publications, and the pamphlet section has been moved to a more spacious area.

Virtually all the branch libraries were visited during the course of the year and guidance was maintained from the Central Library. There were certain matters of common interest which required

REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

LANDBOONAVORSING
AGRICULTURAL RESEARCH

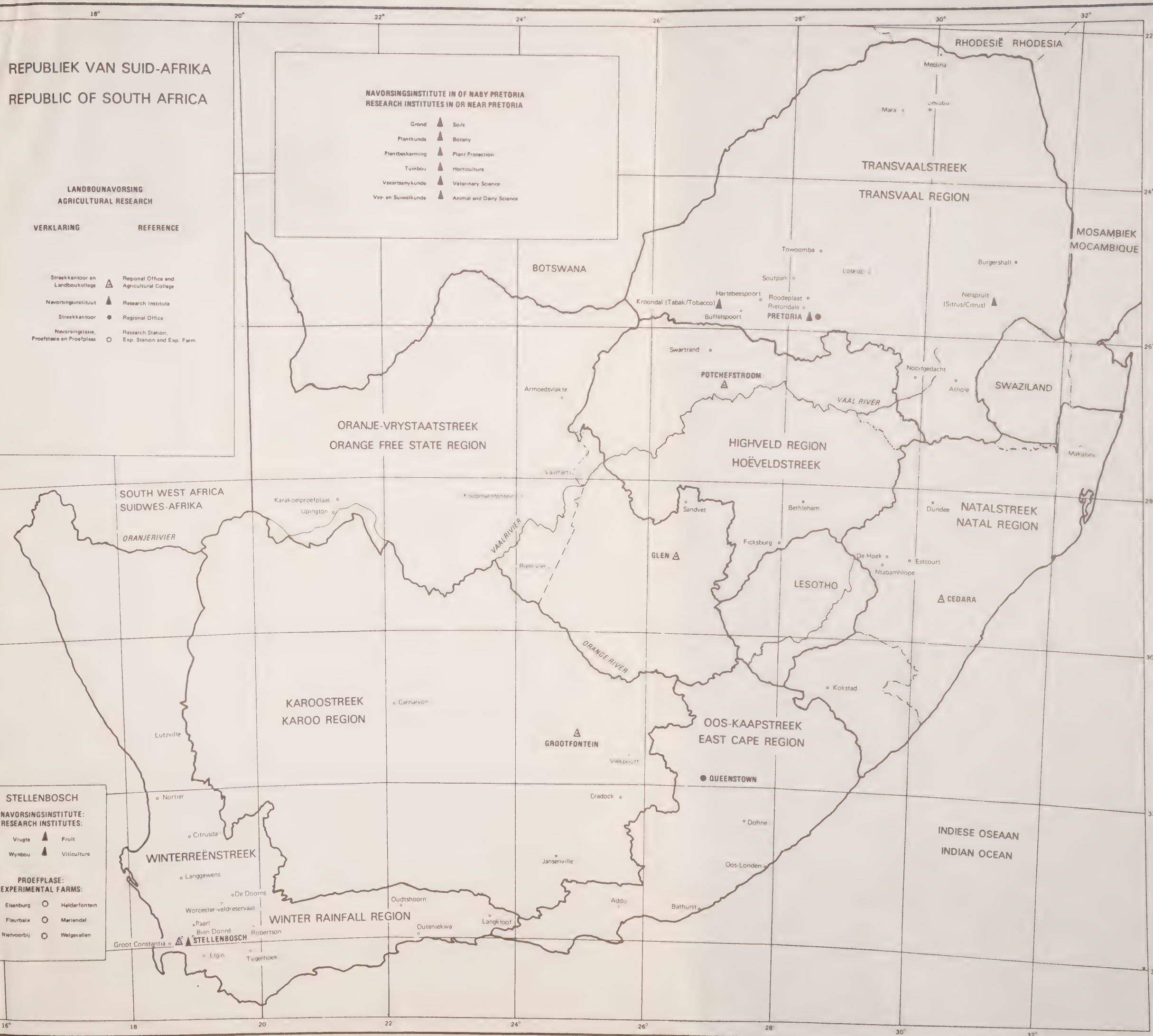
VERKLARING

REFERENCE

- Streekkantoor en Landboukollege
Navorsingsinstituut
Streekkantoor
Navorsingstasie, Proefstasie en Proefplaas
- Regional Office and Agricultural College
Research Institute
Regional Office
Research Station, Exp. Station and Exp. Farm

NAVORSINGSINSTITUTE IN OF NABY PRETORIA
RESEARCH INSTITUTES IN OR NEAR PRETORIA

- Grond
Plantkunde
Plantbeskerming
Tuinbou
Veeartsenykunde
Vee- en Suivelkunde
- Soils
Botany
Plant Protection
Horticulture
Veterinary Science
Animal and Dairy Science



STELLENBOSCH

NAVORSINGSINSTITUTE:
RESEARCH INSTITUTES:

- Vrugte
Wynbou
- Fruit
Viticulture

PROEFPLASE:
EXPERIMENTAL FARMS:

- Eisenburg
Fleurbaix
Nietvoorbij
- Halderfontein
Mariendal
Welgevallen

intensive discussion. For this purpose, a day was set aside during the orientation course of the Division of Library Services, and attended by qualified personnel from the branch libraries.

Exchange of publications with overseas

countries is another important function to be fulfilled by the library. New exchange agreements are continuously being arranged and control is exercised to ensure that these agreements are observed.

VI. Supporting Services

BOTANICAL RESEARCH

Botanical research is making good progress - as is evident from the increase in the number of publications during the past year. These publications covered a wide range of subjects of a fundamental and applied nature. This can be regarded as a response to the growing need in this country for a wide range of botanical information. The quality of the journals and other publications produced is of an international standard as is borne out by the increased interest shown in them locally and overseas.

Efforts to speed up the production of *Flora of Southern Africa* are taking effect and the sharp increase in the number of contributors, particularly from overseas, augurs well for the future of this vitally important project. The new developments in the field of cryptogams, particularly the work on a volume on mosses, the publication of a fascicle on Characeae and the possibility of producing a volume on ferns, are encouraging. The production of standard works of reference in Botany, in which the Department should rightfully take the lead, is progressing and a volume containing biographies of plant collectors and a bibliography on botanical literature have been completed, whereas a bibliography of references to ecological publications is far advanced. Botanists in the Department have collaborated, with scientists in other institutions on national and international projects.

The nature conservation authorities were assisted via NACOR, the co-ordinating body for nature conservation, with the programme on the establishment of a national network of nature reserves. Active participation in the Nylsvley Ecosystem and the Fynbos Biome Projects is a feature of our ecological research effort, and on the international front, assistance in combating *Salvinia* (Kariba weed) was given via SARCCUS. The growing role that the botanist is playing in controlling pest plants highlights the basic importance of the botanical sciences, including taxonomy.

Generally, the trend has been towards greater integration of botanical work in the environmental planning and development of the country.

FLORA RESEARCH

Flora of Southern Africa

Following the publication and distribution of the new format, the project has entered a new phase and it is foreseen that publication of new

volumes and fascicles will in future be much faster than before. Apart from taxonomists of the Institute, 26 researchers from South Africa and overseas countries have already offered to participate.

A new series on cryptograms was launched with the publication of a volume on Characeae. Further volumes in this series are in preparation, one on Bryophyta and one on Pteridophyta, and two fascicles on lichens have been offered.

The following volumes on plant groups are at an advanced stage of preparation, or appeared during the year under review:

- Vol. 3. Work on *Mariscus* (Cyperaceae) and related genera is far advanced.
- Vol. 4. Three families have been revised and written up: Xyridaceae, Eriocaulaceae and Juncaceae. Together they represent about 40 species. Work on the genus *Aneilema* (Commelinaceae) is nearing completion.
- Vol. 5. Revisions of *Ornithogalum* and *Tulbaghia* were published.
- Vol. 10. Loranthaceae and Viscaceae, totalling about 50 species, will soon go to the printers.
- Vol. 11. *Lampranthus* and *Gibbaeum* (Mesembryanthemaceae) with about 75 species were completed and are being prepared for publication.
- Vol. 12. A revision of Menispermaceae was completed.
- Vol. 14. A revision of the family Crassulaceae with about 400 species will be ready for the printers during 1979.
- Vol. 17. Revisions of *Sarcocaulon* and *Monsonia* have been prepared.
- Vol. 21. A part comprising Tiliaceae, Malvaceae and Bombacaceae should be ready for printing in 1979.
- Vol. 25. A revision of the genus *Griesebachia* (Ericaceae) was completed.
- Vol. 27. A fascicle on three genera of the Asclepiadaceae will be ready for the printers before the end of 1978: *Brachystelma* (70 species), *Ceropegia* (65 species) and *Riocreuxia* (7 species).
- Vol. 28. A revision of the 250 species of Lamiaceae is far advanced.

Botanical collectors in Southern Africa

The biographical notes on botanical collectors in Southern Africa were completed and a start made on the preparation of a historical

introduction. Approximately 350 photographs and illustrations that will accompany the text were collated and attention was given to preparing the manuscript for the press.

Bibliography of South African Botany

This work, which will be a standard reference on taxonomic publications, is in the final stages of publication.

Register of plant taxonomic projects

A register listing some 250 taxonomic and related projects in Africa was compiled with the aid of a computer and distributed world-wide in the form of microfiche cards. A new edition is projected for 1979.

Southern African Plants

For this series of one-page brochures numbers dealing with 150 grasses and 15 water weeds are at an advanced stage of preparation.

Pretoria Flora

Line drawings of 468 species were produced and brief descriptive keys to these plants were drawn up. Descriptions of 24 families and 99 species were finalised for the printer.

An introductory chapter was written on the flora through the seasons.

Liaison Officer, Kew

Specialist information was provided for taxonomists in South Africa. A selection of 560 specimens of South African Cyperaceae was checked and named against material at the Royal Botanic Gardens, Kew, as a basis for a revision of the family. All the Kew type specimens of Cyperaceae for South Tropical Africa, Madagascar and Southern Africa were photographed. Ten herbaria in Britain and Europe were visited to record the occurrence of Cyperaceae material and literature.

ECONOMIC BOTANY

Plant utilisation

Over 300 one kilogram plant samples for initial screening for activity against cancer were sent to the USA. Bulk collecting of *Putterlickia verrucosa*, one of the most promising plants, continued and about 400 kilograms of material was despatched to the USA for use in clinical testing. Three hundred requests for information about plants and their economic attributes were answered, and there is undoubtedly growing interest in the utilisation of indigenous plants.

In response to requests from the private sector, candidate sources of essential oils, gums, etc, were reviewed and sample collections were made.

Ethno-botany

A pilot study of the ethno-botany of the Tsonga people in the Gazankulu area of the North-Eastern Transvaal has been completed and is being prepared for publication.

Weeds

Extension material, brochures and slide series were used to inform farmers and members of the public about the dangers of nassella tussock, and the means of control available to us. The extent of the nassella tussock problem was re-assessed and control recommendations were formulated, with the assistance of Mr A.J. Healy, a fellowship holder from New Zealand.

Further investigations into the occurrence and distribution of *Prosopis* (mesquite) species in South Africa were carried out, and the material collected is being evaluated. Assistance was given to the Department of Water Affairs in monitoring the *Eichhornia* (water hyacinth) population at Hartbeespoort Dam before and during the successful spraying operation that was carried out there.

The study of *Lantana camara* was continued. Material was collected in the Pretoria area, hybrid swarms investigated in the Eastern Transvaal and the chromosome numbers of about 100 collections established.

Chromosome numbers range from the diploid to the hexaploid level. A living plant collection of all the variants identified has been established as an aid to further investigation.

Chromosome numbers range from the diploid to the hexaploid level. A living plant collection of all the variants identified has been established as an aid to further investigation.

The draft national weed list now contains names of about 450 weed species occurring in South Africa. These have been drawn from literature and herbarium sources, but will be added to from field work on a distribution survey of weeds in South Africa. An illustrated guide to the identification and control of plant invaders in the Cape Province was compiled and edited for the Cape Department of Nature and Environmental Conservation, and will be published in July 1978.

Poisonous plants

The abstraction of literature references on over 600 poisonous plants occurring in South Africa has been completed. These include: ornamental plants, poisonous weeds, poisonous wild (veld) plants, poisonous industrial plants, aquatic plants and toxicants occurring naturally in foods.

Distribution of trees in the Transvaal

A further 271 field listings of woody plants were made and to date over 1400 of the approximately 7000 1/16th° squares that occur in

the survey area have been sampled (i.e. about 20%). But further sampling is needed in order to achieve the sampling level required for an atlas of the distribution of woody species.

GOVERNMENT HERBARIA

Information

A total of 33 500 plant specimens were identified for officers of the Institute, various Government departments and provincial bodies, universities and the public. In cases of poisoning material was identified for the police and for Onderstepoort. The herbaria of the Institute dealt with 2 327 visitors requiring information on herbarium practices and plant identifications was supplied to several Governments of Black States. As a result of problems with the programme, the information service was not able to obtain assistance from the data bank.

Development

The herbaria of the Institute, the National Herbarium in Pretoria and the regional herbaria in Durban, Grahamstown, Stellenbosch and Windhoek were increased by the addition of 32 500 plant specimens. Collecting expeditions to various areas, with major expeditions to Lesotho and the Richtersveld, were undertaken by members. Material was sent out on loan to institutes throughout the world for research purposes, 7 100 specimens being sent from Pretoria. The exchange programme with overseas herbaria continued, with

9 300 specimens being sent out from Pretoria and an equivalent amount received.

The repackaging and renovation of the 14 000 specimens in the bryophyte collection in Pretoria is approximately two-thirds complete. The collection is being changed to a vertical filing system which will result in a considerable saving in space and material. In addition, the collection will be far more accessible and easy to use. Some 4 430 specimens have been received on loan for study.

Research

Taxonomic research by staff of the herbaria in a wide spectrum of plant groups is continuing. The following groups were studied: Fabaceae, Cyperaceae, Poaceae, Ericaceae, Hypoxidaceae, Geraniaceae and mosses.

Cyperaceae

- (a) Investigation into *Ficinia*, *Eleocharis*, *Carpha*, *Carex* and *Chrysanthrix* are well advanced and include morphological, anatomical, embryological and palynological aspects. The account of the Cyperaceae for the *Flora of South Central Transvaal* was completed.
- (b) *Mariscus* in Southern Africa: During the past year a considerable amount of new nomenclatory information was obtained, which made the finalisation of nomenclature possible. This necessitated several changes of name. It was possible to start making a final



Dr W.A. Verbeek, Secretary for the Department, speaking on the occasion of the celebration of the 75th anniversary of the Botanical Research Institute. The photo was taken during the luncheon attended by hundreds of guests and prepared from edible plants that occur in Africa

written record of the results, revising them at the same time where necessary.

Unlike the results obtained by other researchers with other plant groups, the results of the electron microscopic examination of pollen and fruit surfaces were disappointing from the point of view of broad classification, but in certain cases they were useful for identification on a species level. The classification made on the basis of external characteristics is borne out by anatomical data.

Critical evaluation of the morphological and anatomical characteristics resulted in 4 different genera (2 new), 5 subgenera, 3 sections (1 new) and about 50 species (7 new) being distinguished.

Geraniceae

Gas-chromatographic studies of the oils of the subgenus *Campylia* of the genus *Pelargonium* showed that they were of little use in differentiating taxa and that reliance should rather be placed on the morphological and anatomical features. The anatomy of the petiole is of taxonomic importance and showed that two new species fitted into the section. The literature, types and synonyms of the species have been traced and the descriptions are being prepared.

Ericaceae

The study of the minor genera of the Ericoideae in Southern Africa is continuing. The genus *Grisebachia* was revised, resulting in a reduction in the number of species from twenty-one to nine. The investigation revealed the complexity of species relationships, indicating relatively recent speciation within this genus.

A taxonomic monograph of *Lampranthus* and allied genera (Mesembryanthemaceae)

All research work on this group of succulent plants, which is confined mostly to the drier parts of the country, has been completed and the resulting thesis is being prepared for submission. This is the first comprehensive study of the group, which is composed of three genera, 61 species and two subspecies. An account of the group for *Flora of Southern Africa* is in preparation.

The subtribe Ruschiinae (Mesembryanthemaceae)

A taxonomic project on this group of succulent plants was started recently. It will deal with 538 species in 14 genera. Modern research aids to be used in this project include computer-aided group-forming and key construction and scanning electron microscopy.

Hypoxidaceae

The comparative anatomical studies within this family have been completed and published. A start has been made with the taxonomic revision in

that the small genus *Pauridia*, two species endemic in the South-Western Cape, has been completed.

Poaceae

The descriptive and analytical keys to the 224 species represented in the *Flora of South Central Transvaal* were completed.

Studies in the genus *Pentaschistis* are continuing, mainly on the summer rainfall species. Two new records for Southern Africa were recorded and a five-species complex was recognised in the Drakensburg of Natal and Lesotho.

Mosses

A preliminary taxonomic survey of the bryophytes of Southern Africa was completed and as a result an annotated checklist of the group is ready for publication. Work on a moss flora for Southern Africa is well under way and two of the 53 families to be covered in the flora have been completed.

BOTANIC GARDEN

Good progress has been made with the development of the garden. At present the stages of development, in terms of land area, are: 25 % underdeveloped (at the planning stage), 20 % at the first stage (with basic layout and planting completed), 50 % at the second stage (with plantings well grown), and 5 % at the third stage (with replanting and refinement in progress).

Garden accession numbers stand at over 23 700, representing 6 000 - 7 000 species, including 512 tree species.

The paving of roads is now 70 % complete, the reticulation system is 35 % complete, and there are 7 boreholes capable of delivering a total of 46 500 litres of water per hour. But, unfortunately, some of these boreholes and 2 - 3 hectares of land may be lost if plans to widen the Silverton road are carried out.

ECOLOGICAL RESEARCH AND SURVEYS

South African Savanna Ecosystem Project

During the past growing season attention was given to the important root growth component of the savanna ecosystem. An underground viewing chamber was used for this project. It became clear that root tip growth of most woody plants occurred in late summer and early autumn. It was also established that the agricultural problem plant, lekkerbreek (*Ochna pulchra*), has at least half its mass below ground. This, together with the fact that many of these plants are connected to one another below ground and have feeder roots a few millimetres below the soil surface, makes it clear why this species is successful in competition with grasses and why it is able to recover quickly after removal of its aboveground parts through burning or other means.

Veld Types of South Africa

With the perfecting of the system of symbols for describing species, its application to some 6 000 species found in the 30 veld types under consideration and the incorporation of many name changes, it at last became possible to start the final writing up of the revision of Veld Types of South Africa. A preliminary article, entitled "The flora that matched the Fauna", was completed. In this article a reconstruction of the vegetation before it came under the influence of the pastoralist is attempted. Twelve veld types were described, viz. Nos. 1(d), 2(a),(b),(c),(d),(e); 34(a),(b),(c),(d); 46(a),(b); 23(e); 47(a),(b); 31(a),(b),(c); 28(a),(b); 33(a),(b); 43(a),(b),(c),(d),(e); 60(a),(b),(c); 25(a),(b),(c) and 24, with emphasis on their original pre-pastoralist state as well as on their present state.

Western Transvaal Bushveld Survey

The vegetation survey of the Western Transvaal bushveld types is near completion. The syntaxonomy and synecology of about 30 plant communities distributed over four of Acocks's veld types is being described. The results permit a preliminary breakdown of these veld types, mainly on a floristic-physiognomic basis. Units recognised in this way are considered to be of value for regional planning purposes. The application of results in farm planning and extension work is being investigated. The study will also make an important contribution to the construction of a hierarchical classification of Transvaal bushveld vegetation.

Zululand Coastal Dune Survey

The first phase of this survey was completed with the publication of two reports, namely "Conservation priorities in the dune area between Richards Bay and Mfolozi mouth based on a vegetation survey", which appeared in the Natal Town & Regional Planning Report No. 38, and "Changes in area of grassland on the dunes between Richards Bay and the Mfolozi river 1937 to 1974", which will appear (in press) in the Proceedings of the Grassland Society of Southern Africa.

A third manuscript, dealing with the changes in the vegetation of the study area that can be detected when aerial photographs taken in 1937 are compared with those taken in 1974, is being prepared.

Cape Mountain Fynbos Surveys

Vegetation survey of the Cape of Good Hope Nature Reserve

A short survey of the status of rare, endangered and endemic taxa on the Reserve was undertaken. It was found that: (1) the percentage of rare species in each family shows a distinct correlation with the restriction of that family to the

Cape flora; (2) seed-regenerating species - those that are most liable to extinction by repeated burning - constitute by far the largest category of rare species; and (3) the uncommon, specialised habitats harbour the greatest concentration of not only rare species as a whole but also those seed regenerators and endemics that are measures of the vulnerability of the habitat.

These figures emphasise the need to exercise the greatest care in managing habitats, especially those that are rare.

A primary survey of the Rooiberg Mountain Catchment Reserve near Ladismith, Cape

Eight major physiognomic categories of vegetation and about 20 variations and minor categories were described and mapped. Though there are no clear-cut boundaries, these categories agree with the major physiographic/climatic features of the reserve. In the warmer, drier habitats of the lower slopes, narrow-leaved sclerophylls, including ericoids, predominate. On upper, cooler slopes with northerly aspects, restioid forms increase; while the shady, moist south-facing slopes have a tall dense proteoid community.

Despite its limited scale, the quantitative floristic survey, still in progress, indicates a most satisfactory correlation between the physiognomic and subsequent phytosociological classifications.

Fynbos biome environmental project

In November to December 1977, possible locations for research sites in mountain and coastal fynbos were inspected by the Task Group.

A week-long workshop was held in April 1978, to gather data on structural/functional characteristics to be used in the reconnaissance survey of fynbos. Several parameters that seem significant in reflecting the vegetation/habitat relationship were selected for further study.

Distribution and autecology of *Hakea* pest plants

A distribution map for *Hakea sericea*, *H. gibbosa* and *H. suaveolens* has been produced; the map also indicates areas into which *Hakea* may spread. Growth, flowering and fruiting times in the field and the relationship between the root and shoot system of plants in a nursery were studied.

A method of estimating fruit mortality by biological control agents has been designed and field tests have been completed.

Cape Coastal Fynbos Surveys

Semi-detailed survey of the vegetation of the western and southern Cape coastal lowlands

Several collecting expeditions, a necessary preliminary in any botanical survey, were made through the area, to determine the identity of component species and become familiar with the area and its vegetation.

The available orthophoto maps (1: 10 000 scale) were studied and the natural vegetation, disturbed, undisturbed and invaded by exotic species, was demarcated. These details, together with geological information, were introduced on 1: 50 000 maps. This will be the mapping scale used during this survey.

On the basis of the above information, a first transect from Langebaan to the mountains near Saron, 5,5 km wide and nearly 100 km long, was selected for detailed study. Sampling along this transect has progressed from the sea to the farm Theefontein north of Darling. This sampling will be continued eastward during the coming year.

Orothamnus project

Monitoring of the growth, phenology and population dynamics of *Orothamnus*, the marsh rose, was continued in the Kogelberg State Forest.

Aquatic ecology

Natural lakes and pans, large dams, reservoirs and farm dams, generally not smaller than 5 hectares in area and at least ten years old, were surveyed for aquatic macrophytes in Natal. Over 400 stands, distributed over 110 water bodies, were surveyed. A final draft of the report on the survey is virtually completed and will be submitted for publication.

Research into the application of growth kinetics for the control of *Eichhornia crassipes*, through nutrient removal by mechanical harvesting, was given top priority this year. Two lines of investigation have been pursued, viz:

- (a) The determination of kinetic constants:- i.e. maximum specific growth rate, half-saturation constant and yield co-efficient under nitrogen- and phosphorous-limiting conditions in culture; and
- (b) The determination of growth rates of *Eichhornia* plants under field conditions. The purpose of field investigations is to determine the relations between laboratory-determined growth responses and those measured in the field. A vast amount of data has been collected both in culture and in the field and is presently being computed and analysed.

Joint South Africa-Botswana *Salvinia molesta* (Kariba weed) survey and pilot control project in the Kwando-Linyanti River System

The monitoring of the spread of *Salvinia molesta* and the effects of spraying was continued in the Linyanti-Kwando River System on the Caprivi-Botswana border region. On the Kwando River unusually high floods during the normal winter flood season have contributed greatly to the dispersion of the weed into the surrounding swamp areas. The rate at which the build-up of *Salvinia* in the Linyanti-Kwando swamps is occurring thus appears to have been accelerated, as has also been its southward and eastward movement from the

Kwando River. On the other hand, the westward spread of *Salvinia* from the older Linyanti River infestation has remained static, although here too the high water-level has dispersed the plant in the swamps.

In the Linyanti River the main channel of the stream remained open where it had been chemically sprayed during 1975 and 1976. However, the channel has started to close again in the past few months as a result of regrowth and encroachment of *Salvinia* from the surrounding reed swamps, where spraying is ineffective because of the reed cover. Similar results are, as expected, being obtained in the trial spraying areas of Lake Liambezi. Oxygen determinations of the water in the sprayed areas which have been cleared have indicated no residual ill-effects, as was feared might occur from the large amounts of rotting plant material. By comparison, much lower oxygen levels were recorded where *Salvinia* mats were present.

In the area where the biological control agent, *Paulinia acuminata*, has been released the acrydid grasshopper continues to survive, but under the difficult swamp terrain conditions precise population numbers have been difficult to obtain. So far, its effect on the growth of *Salvinia* has been negligible.

National Conservation Plan

The Botanical Survey Section still co-ordinates the National Conservation Plan for the Department of Planning and the Environment in co-operation with an officer of that Department. The first report to NACOR was submitted and approved. Since then a number of steps have been taken to streamline the operation and accelerate the rate of progress.

DATA PROCESSING

The herbarium data bank has acquired the acronym PRÉCIS, standing for PRÉ (the Index Herbariorum code for the National Herbarium, Pretoria) Computerised Information System. Almost all the planned facilities are being tested and a team of four data encoders is keeping up with the flow of new specimens into the herbarium as well as making amendments to existing data. Although not yet operational on a routine basis, the first answers to queries were produced by PRÉCIS during the year. Testing should be completed during the forthcoming year.

A number of other activities involving the use of the computer, including Braun-Blanquet ecological surveys, modelling and data banking for the South African Savanna Ecosystem Project, indexing for bryophyte taxonomic studies and group-forming for taxonomy, were dealt with on a routine basis.

PUBLICATIONS

During the year Vols 12,2 & 12,3 of *Bothalia* appeared in print. The latter was a bumper issue of

Two of the succulents *Dinteranthus wilmotianus* subsp. *wilmotianus* and subsp. *impunctatus* which are included in the special number of Flowering Plants of Africa published on the occasion of SUCCULENTA 78, the international congress on succulents held in Pretoria in 1978



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256 pages with 21 articles and 32 contributors. Vols 44,3 & 4 and 45,1 & 2 of Flowering Plants of Africa were published, the latter being devoted entirely to succulent plants to mark the occasion of SUCCULENTA 78, which was held in Pretoria during July 1978.

Two Memoirs of the Botanical Survey of South Africa appeared, namely Nos 41 & 42. Vol. 9 (Cryptogams) of the Flora of Southern Africa comprising a revision of the Characeae was published. Altogether 116 scientific papers were published by the staff of the Institute during the year under review.

PLANT PROTECTION RESEARCH

NATIONAL COLLECTION OF INSECTS

Specialised taxonomic studies

Hymenoptera

Most of the research still centres around the taxonomic study of two important families of the parasitic wasps, namely the Encyrtidae and the Aphelinidae. Accessions of these groups now

amount to 5 350, with an increase of 225 during the past year.

Good progress is still being made with building up the collection of other families of the Chalcidoidea, which was started recently. A few thousand specimens were collected by means of collecting nets and suction traps, and the collection now consists of about 8 000 mounted and labelled specimens, divided into families.

In addition to this collection, a few hundred specimens collected in Australia by Dr M.A. van den Berg were also acquired. These specimens were collected in the course of a search for the national enemies of *acacias* in Australia. Several valuable type specimens received from Dr Z. Boucek of the Commonwealth Institute of Entomology in London were also added to the collection. In addition to the Chalcidoidea, a large number of specimens of species of the Proctotrupoidea - a group of parasitic wasps that is also of economic importance - were collected, mounted and sent to Dr L. Masner of the National Collection of Insects of Canada for identification.

These specimens were collected in the course of two collecting trips - to Northern Zululand and South-West Africa - undertaken together with other researchers of the Institute.

Identification

Several indentifications of parasitic wasps, associated with insect pests that are of importance in biological control programmes, were carried out. Identifications were undertaken on behalf of researchers in the Republic, Rhodesia, Mauritius, Réunion, Israel, Crete, Japan, Malaysia, Australia and the United States.

Several taxonomic studies reports on some of which have already been submitted for publication, were completed during the past year. Several new species of Encyrtidae, which are potentially of economic importance as natural enemies of scale insects, were described.

A taxonomic revision of the genera of the African Encyrtidae was completed. This study includes the following: the description and redescription of 117 genera, the compiling of keys for the identification of the African genera of the family; the compiling of host and host plant catalogues and the cataloguing of all the African species of the Encyrtidae.

Xylocopa

This research entailed a taxonomic study of carpenter bees of the genus *Zylocopa*. Revision has become necessary because virtually no previous work had been done in South Africa on the systematics of carpenter bees. About 2 000 specimens were collected and incorporated into the National Collection and the identification and taxonomic study of the material has been started. The rest of the higher Hymenoptera collection has been given curatorial attention and new accessions have also been incorporated into the collection.

Pods and seeds of 41 of the 45 indigenous *Acacia* species were collected during the past 24 months. Collecting trips to the Transvaal, Natal and South-West Africa were undertaken.

The redescription of about 35 weevil species which have been collected from the pods has been started. Electron micrographs of each species have been taken.

The National Collection of Insects' collection of Bruchidae has been expanded from about 300 specimens before the start of the project to about 4 500 mounted and 1 000 unmounted specimens. In the course of the collecting trips other pods were collected in addition to thorn tree seeds and the insects acquired in this way were included in the National Collection.

Isoptera

Systematic studies of termites included a review of the Southern African species of the tropical genus *Cryptotermes*, a pest of timber and furniture, and a revision of the genus *Lepidotermes* (Termitinae), a humus-feeder endemic to Southern Africa.

Routine determinations of Isoptera, including samples submitted by the public, amounted to 460 series. The annual increment to the collection was

409 series, of which 326 were taken in the Republic by NCI staff members and the balance was collected at various times in several foreign countries by correspondent naturalists and scientists. Twenty-four genera are represented in this increment, which brings the total number of termite samples in the National Collection of Insects to 33 192 on 30 June 1978.

Two field survey trips were undertaken to Natal and one to the Northern Transvaal. Attention was given to complete excavation of *Macrotermes* and *Odontotermes* nests in order to obtain nest series complete with functioning reproductives and make thorough searches for termitophiles possible.

Data on the occurrence of winged termites have been incorporated in the NCI alate calendar, which is maintained to guide the correct timing of field surveys.

Neuroptera

Two collecting trips to South-West Africa were undertaken during the past year and 650 larval *Crocinae* were collected. A further 100 specimens were collected in the Cape. The collection of lace wings now consists of 2 300 specimens, which have been given curatorial attention and brought to Pretoria in December 1978. Two taxonomic studies were completed during the year and the results published.

Tephritidae

There has been little beyond the work on the *Dacinae*. Various identifications of various *Diptera* have been made for the Collection. Mr A. Freidberg of the Tel-Aviv University has asked for the loan of further fruitfly material for special study.

Further correspondence with Mr B.H. Cogan of the British Museum about work on the *Ceratitidae* has not led to any definite proposals. *Dacine* flies from the Cape Verde Islands sent by Dr H. Laven of the Johannes Gutenberg-Universität, Mainz, Germany were identified as *Didacus frontalis* (Becker).

Dacine flies were reared by Mr M.B. Bayer, Curator of the Karoo Botanic Gardens, Worcester, from flowers and leaves of a *Ceropegai* (*Asclepiadaceae*). They are "*Dacus*" *apoxanthus* Bezzi, a small species first taken in East London 50 years ago. An interesting discovery.

Coccoidea

Research on scale insects and mealybugs was continued and many additions were made to the National Collection, some from new material sent in for determination and some from old, stored material that had to be mounted and identified.

A working atlas was completed. It consists of an illustrated folder showing all the mealybugs and soft scale insects from Africa south of the Sahara and giving records of the distribution of these



It was established in the South African savanna-ecosystem project at Nylsvley that at least half the mass of the *Ochna pulchra* (lekkerbreek) tree is underground

species. A similar atlas dealing only with the genera was completed. Both atlases will greatly facilitate information retrieval.

Approximately 150 determinations of species received from institutions and researchers in South Africa as well as from North America (California), India, Rhodesia, Israel, Uruguay and Greece were carried out.

General curatorial services

The Nylsvley collecting project

It was decided that the National Collection should undertake a qualitative survey of the insects in the Nylsvley Nature Reserve. Although the programme was started at the end of the season, 583 species have been collected, pinned up and labelled. A further 1 179 specimens have not yet been identified.

Collection and accessions

Collecting trips were undertaken to Zululand and South-West Africa during the past year. 4 265 specimens were collected, mounted and labelled. The specimens represent nine orders and 92 families. Apart from this material, 561 specimens consisting of long series, about which biological data are known or of which the subspecies names are known, were collected. The material represents seven orders and 42 families.

Care of the General Collection

The transfer of the Collection to unit cases and the rearrangement of the specimens are almost complete. Over three quarters of the Collection, or 1 720 drawers, have already been transferred. Alcohol material, including the Thysanoptera collection, is now stored in freezers purchased for this purpose.

Identification service

The identification service of the General Collection is still functioning extremely well. During the past year 66 tasks, which included 341 identifications, were completed. Identifications were carried out on behalf of Departmental bodies, regions and institutes, the University of Pretoria, the College for Advanced Technical Education, private firms, scholars and the general public.

Liaison with the public

The National Collection again fulfilled an important function with regard to liaison with the public. Numerous telephone calls and queries on insects and entomological problems were received weekly. Numerous letters containing queries are also received and a number of persons visited the Collection. Identifications were made for a number of students from the College for Advanced Technical Education who visited the Collection.

CHEMICAL CONTROL OF INSECTS

Pesticide residues

The occurrence of organochlorine pesticide residues in meat and processed meat products was investigated. An analytical technique was worked out in co-operation with the Chemical Laboratory of Department of Health and the City Laboratory of Johannesburg and used to analyse 90 meat samples.

The analyses showed that dieldrin concentrations in excess of the maximum residue limit occurred in 48 % of the beef samples, 13 % of the mutton samples and 33 % of the pork samples. A number of processed meat samples were also analysed and dieldrin was found only in Vienna sausages. Other pesticides found in concentrations in excess of the maximum residue limits were alpha and beta BHC and DDT in beef, alpha BHC in mutton and alpha BHC and DDT in pork, while endosulfan was found in Vienna sausages.

It is not clear how dieldrin is ingested by the animals, since no products containing dieldrin are registered for use on animals or forage crops. Even where malpractices occur, it is not clear whether application to forage crops or direct application to animals to control ectoparasites is the most important factor. Feeds were suspected and 40 feeds or feed ingredients were analysed. These included 10 samples of mixed dairy mash, 13 samples of bone meal, 11 of lucerne meal and 6 of maize. Dieldrin was found only in two dairy samples, in very low concentrations in both cases.

It therefore appears that commercial feeds are not the reason for the occurrence of high dieldrin concentrations in meat. In other words, malpractices must be occurring on the farms.

A highly ingenious technique for determining camfechlor in meat was worked out. Camfechlor is commonly found in dairy products, but an analysis of 80 samples showed that it is not a problem in meat.

In co-operation with the National Programme for the Environment, a number of game samples were analysed for organochlorine pesticide residues. The samples were collected by the Division of Nature Conservation of the Transvaal Provincial Administration.

Indications of organochlorine pesticides were found in all the samples, but at very low concentrations.

Low-volume manual spraying was compared with high-volume manual spraying in a trial with monocrotophos on tomatoes. The results show indisputably that the correct calibration of low-volume spraying equipment produces a lower precipitation.

The first step in determining the incidence of pesticide residues in vegetables and fruit was to examine the analytical method. When organochlorine pesticide residues in vegetables were determined a method of purifying the extract from foreign matter had to be worked out. Fluid chromatography was used as a cleaning method. The work has not yet been completed but so far thin-layer chromatography appears to be the ideal technique.

The organic solvents used for extraction are important, because a poor solvent would produce inaccurate results. Several solvents were tested and methylene chloride produced the best extraction throughout. These results were obtained with peaches, and still have to be confirmed with other crops.

A high concentration of bromide ions was found in glasshouse crops after methyl bromide fumigation. This led to an investigation into the presence of bromide in South African crops especially crops grown in tunnels. Sterilisation of the soil with methyl bromide is a general practice in tunnel cultivation. The methyl bromide fumigation results in higher bromide ion levels in the soil and these are concentrated in the plants. A preliminary investigation into the occurrence of bromide ions was carried out; crops grown both in tunnels and in

the open air were analysed. The results indicated that there is an increase in bromide ion concentration in tunnel-grown strawberries. These results have still to be confirmed.

The effect of spraying equipment on the penetration and precipitation of endosulfan on cotton was investigated. It was found that spraying equipment has to be carefully evaluated for its ability to give an even cover. Other important factors are the penetration of the pesticide to the lowest leaves of the cotton plant, and to the reverse sides of the leaves. There are clear differences between the various commercial spray pumps.

An investigation to determine the effect of precipitation on beneficial insects was started. The property of pesticides that has the greatest effect on beneficial insects in an integrated control programme is the residual action of the pesticide residues on the surface of the plant. Superficial residues are already being determined. Techniques that can be used to determine the biological effects of these residues are also being investigated.

Cotton insect pests

Population trends of the American bollworm on cotton in the Groblersdal and Rust de Winter areas followed the normal cycle, as observed in these areas over the past few seasons. A low level of infection was encountered at the start of the season, from October to December. However, a few sprayings to control the American bollworm were necessary during that period. The population level increased from January to the end of April and weekly spraying was carried out.

In the Komatipoort area the population pressure reached a level which made spraying an economic proposition right at the start of the season and consequently weekly spraying had to be carried out up to the end of the season. However, several producers in this area had difficulty in controlling American bollworm effectively with the recommended endosulfan pesticide.

As a result an investigation was carried out in the area to determine whether there had not been a build-up of resistance to endosulfan. Laboratory evaluation with a population collected from the problem areas showed a resistance factor of 2 to 3 times the recommended dose. Careful attention will have to be given to the matter in this area and in other cotton-growing areas in future in order to determine whether resistance is developing.

Several new pesticides were evaluated under field conditions during this season. The synthetic pyrethroids, cypermethrin, decamethrin and sumiciden, and the carbamates CGA 45156 and UC 51762, appear very promising for use against the bollworm complex. Signs of mite stimulation were encountered when the carbamates were used, however.

BIOLOGICAL AND INTEGRATED CONTROL OF INSECTS

Stemborers and American bollworm

A study of the possibility of controlling stem borers in summer cereals and American bollworm by biological means, through the use of natural enemies, led to the development of effective mass breeding techniques for stem borers and for alternative hosts for the parasites of bollworms. Large numbers of stem borers can now be bred in order to breed parasites of the borer and test grain sorghum cultivars for resistance to stem borers.

An imported egg parasite of the American bollworm, namely *Trichogramma pretiosum*, which was released on cotton in large numbers last year, was recovered in low numbers this season. This parasite therefore appears to have established itself and there is a possibility that the population could increase next season. Ten thousand of these parasites were again released at Groblersdal this season.

The percentage egg parasitism of bollworms was considerably lower this season than during the previous season, but no significant difference could be found between the egg parasitism of eggs collected from a sprayed plot and that of eggs collected from an unsprayed plot. A new larval parasite (*Apanteles* sp.), which parasitised up to 50% of the larvae, was found on bollworms at Komatipoort.

A new egg parasite of *Heliothis* spp. was imported from India, namely *Trichogrammatoidea armigerae*, and is already undergoing bulk breeding for release next season. Three thousand of these parasites have already been released and the Citrus and Subtropical Fruit Research Institute at Nelspruit has been supplied.

A larval parasite of stem borers *Sturmiopsis inferens* was also imported from India and a technique for breeding the insect was developed. However, testing of this parasite against indigenous stem borers revealed that the stem borers are poor hosts for the parasite and only 12% of the progeny survived.

The stem borer infestation of 24 grain sorghum cultivars was determined in the field. Although there was a great deal of variation, NK 300 and Gransor 14 were outstanding for their high level of infestation and PNR 8311 and SSK 20 for their low level of infestation.

Karoo caterpillar

The growth of karoo bushes was hampered by the dry conditions which prevailed during the 1977/78 season. Consequently few reports of moths were received and no severe larval outbreaks occurred.

Research efforts centered around a census of Karoo caterpillar larvae in the soil. This indicated a high larval mortality due to the known parasitoids, and the pathogenic fungus *Beauveria bassiana*.

Primary pupal parasitism by some of the bombyliids has been established but does not appear to be significant.

The host-parasitoid interaction is more complex than was previously realised and a better understanding of the relationships, and particularly the role of hyperparasitoids, has become necessary.

Potato tuber moth

The efficacy of introduced parasites in controlling potato tuber moth was studied at three sites in the Southern Transvaal. Parasitism reached the same high levels (at least 90 % in January) as in the two previous years, and there is now abundant evidence that the introduced parasites greatly suppress tuber moth infestations in potato lands except during a dry period lasting more than a fortnight. One or two applications of insecticide are then necessary and these can be applied without detriment because there is equally good evidence that they do not reduce parasitism.

An attempt was made to replace insecticides by a granulosis virus that attacks tuber moth larvae, but is normally rare and sporadic. Although an outbreak of granulosis that eventually affected 80 % of the larvae was induced by spraying a suspension of virus particles, the disease spread too slowly for this measure to be used instead of insecticides, which act instantaneously. Quick action is essential when tuber moth infestations temporarily get out of control, for the natural rate of increase of the moth is very high.

Vine mealybug

A project aimed at spreading and improving the biological or integrated control of vine mealybug *Planococcus ficus* has been initiated. The emphasis is on the table grape region of the Hex River Valley and hymenopterous primary parasitoids.

Samples have been taken of populations of vine mealybug on grapes, as well as various mealybug species on weeds, cultivated plants and indigenous plants in and around vineyards in the South-Western Cape Province. These samples are placed in emergence boxes and the mealybug and parasitoid fauna present are determined.

Besides confirming the presence of *Leptomastix dactylopii* and the absence of *Anagyrus* sp., this work has revealed the presence of three other species of primary parasitoid (*Leptomastidea abnormis*, *Pauridia peregrina* and *Aphycus* sp.) previously unrecorded from vine mealybug in the Hex River Valley.

Cultures are being set up of (amongst others) the local *Anagyrus* sp. with a view to sorting out its identity and possibly introducing it into the Hex River Valley. Consignments of the syrphid, *Ischiodon aegyptius* and the coccinellid, *Chilomenes lunata*, are being sent to England in accordance with the policy of international co-operation to facilitate importation of natural enemies for biological control work.

Field experiments are being planned in co-operation with one Hex River Valley table grape farmer who applies a minimal amount of chemicals to his vines. These experiments are aimed at enhancing natural control of vine mealybug by physically or chemically controlling the pugnacious ants *Anoplolepis* sp., active there.

Wheat aphids

Trials aimed at determining the damage done by aphids to wheat plants of various ages showed that, contrary to the opinion that used to be held, aphid infestations are relatively more harmful on young plants than on older plants. An aphid infestation which started with 15 adult wingless females of *Acyrtosiphon dirhodum* which were placed on 43 day-old plants (before the piping stage) at the start of the experiment and allowed to multiply freely for a period of 21 days before they were removed caused an eventual crop loss of 21,4 %. This loss was due chiefly to a decrease of 23,1 % in the number of kernels that developed in the ears.

Similar infestations, consisting of a mixture of the brown wheat aphid *Macrosiphum avenae* and *A. dirhodum* on plants in full bloom (64 days old) and at the doughy stage (85 days old) had no effect on the number of kernels formed. Slight crop losses were, however, caused - the kernels from plants that were 64 and 85 days old at the start of the 21-day infestation period were 6,5 % and 1,9 %, respectively, lighter than those from uninfested plants.

Plant mites

A predacious mite, *Phytoseiulus persimilis*, which is extensively used in Europe and America for the control of red spider mites, was recently detected for the first time in a breeding stock of the locally occurring predacious mite *Amblyseius* (*Mesoseiulus*) *longipes* which it had supplanted. Experimental release of *P. persimilis* on commercially grown crops of chrysanthemums and orchids in the Western Cape area have given encouraging results.

BIOLOGICAL CONTROL OF WEEDS

Hakea

A further 2 100 *Erytanna consputa* weevils were released at 42 new sites in the South-Western and Southern Cape, which makes a total of 116 releases since 1975. Populations are increasing satisfactorily and at some sites activity has been found over an area of up to 9 ha around the release point three years after release.

Studies on aspects of the biology of the weevil are being conducted in the field. There appear to be two peaks of adult feeding activity during the year, one during late summer and the other during

spring. Compared to larval damage, this feeding may not be very detrimental to the plants. Young females confined singly on plants in the field laid an average of 90 eggs each during their first year. This is considerably more than had been anticipated.

Fruit samples from the Stellenbosch release site of the moth *Carposina autologa*, whose larvae attack mature *H. sericea* fruits, showed that only about 14% of the eggs yielded larvae that successfully entered fruits. This is comparable to the situation in Australia. Mortality of the larvae in the fruits was unexpectedly high and exceeded 80% in the samples. Pyemotid mites appeared to be the main cause of mortality. Second generation eggs were found, but establishment is uncertain.

To attempt to eliminate the very high mortality and unproductive use of the limited numbers of larvae available for release, a new technique of inserting larvae directly into fruits has been developed and this may aid in establishing colonies of this insect. New supplies of eggs from two areas in Australia were collected to augment the laboratory culture.

A start was made with culturing larvae in tagged fruits in the field, thus splitting the risk of losing the laboratory colonies.

Laboratory studies were conducted on the feeding damage and the host specificity of *Cydmaea binotata* (formerly referred to as *Erytenna binotata*). These minute weevils were able to suppress the growth of newly germinated *H. sericea* seedlings, but older seedlings were less affected. They were, however, not able to kill the plants directly.

At present the indications are that the adult weevils are restricted to feeding on *Hakea* spp., but more testing has still to be done.

During a collecting trip to Australia earlier in the year breeding material of promising new candidates was collected. These include a bud gall wasp and a bud gall midge on *H. sericea* and a stem gall midge on *H. gibbosa*.

St. John's Wort (*Hypericum perforatum*)

Another joint attempt with the University of Stellenbosch to culture *Aphis chloris* obtained from Israel failed, and it seems as if the Israeli form of this insect is not suitable for use against the weed in South Africa.

A consignment of plants containing unseasonal larvae of the root borer *Agrilus hyperici*, imported by the University of Stellenbosch, was taken over, and later the adults were caged on potted plants and in a walk-in type of cage near Tulbagh. Changes of establishment are small because the release had to be made at a time of the year when suitable growth of egg-laying was not available.

A start was made with the chemical treatment of odd roadside plants encountered outside the known distribution range of the weed to prevent the development of new infestations, but where

chemical control seemed impracticable, insects were released, e.g. at Somerset West, where the beetle *Chrysolina gemellata*, obtained from California, was released.

At present the weed is of negligible importance in many previously densely infested areas, and the midge *Zeuxidiplosis giardi* continues to thrive.

Jointed cactus

No new insect enemies were introduced from the Americas during the previous 24-month period for the biological control of jointed cactus. Instead, several consignments of *Cactoblastis cactorum* eggs were received from two different ecological regions in Argentina, namely:

- (1) Entre Rios (Guauguaychú) and
- (2) Formosa (Ibarreta).

These two populations were multiplied in quarantine until considerable numbers were obtained and then released on jointed cactus at two localities in the Eastern Cape.

Live specimens of *Dactylopius austrinus* were also received from North-Western Argentina and this new stock is at present being multiplied before release.

Tucumania tapiacola

Laboratory bulk rearing of *Tucumania tapiacola* is providing approximately 50 adult moths per day, which produce between 15 000 and 20 000 eggs per week. These eggs are providing material for releases in a number of jointed cactus infestations. Material is released in two main ways, depending on the situation and growth habit of the cactus at each release site.

Closely monitored small-scale releases have shown that laboratory-reared eggs of *T. tapiacola* are very vulnerable to predators, especially in the more exposed areas where predators are very active. Newly hatched larvae are therefore given cactus joints in the laboratory, before being released in these areas. Once the larvae have penetrated and settled in the joints they are placed in cactus plants at the release sites.

As a result of these releases *T. tapiacola* has been established at two localities. In one area two field-produced generations have been detected since initial release, but there has been no increase in the population numbers at any of the release sites. Dispersal and the mortality factors that might be preventing a population build-up are being investigated, especially the effect of predators (mainly ants) and climatic factors on the egg and young larval stages.

Prickly pear

Concern has been expressed about the possible increase in prickly pear infestations in areas that used to be heavily infested by the weed prior to the biological control campaign of the 1940s.

A three-monthly survey programme was initiated in 1976 for the quantitative evaluation of the effect of the two introduced insect enemies in these Eastern Cape infestations. The insects involved are the prickly pear cochineal *Dactylopius opuntiae* and the moth *Cactoblastis cactorum*.

Although this kind of population survey is a long-term undertaking, three points have already emerged from the study:

- (1) *C. cactorum* appears to be the key factor that prevents massive reinfestation of prickly pear, but the insect is incapable of destroying plants once the stem has reached a diameter of more than 10 cm;
- (2) plants with a stem diameter exceeding 10 cm are killed only by the combined attack of cochineal and *C. cactorum*;
- (3) the effect of these insects on prickly pear varies significantly from area to area in the Eastern Cape.

The progress of the prickly pear borer *Metamasius spinolae* has again surpassed all expectations at Springfontein near Uitenhage. The insect has now spread over the entire farm and large areas have already been cleared of the weed. At Hankey the population did not increase significantly in abundance, but instead dispersed over a much larger area. The infestations at the three other localities remained unchanged.

Lantana camara

A sampling technique and sample size were worked out to determine whether the imported candidates for the biological control of *Lantana camara* had any effect on the growth and reproduction of the plant. Formal plots were started in five different areas to determine the growth potential of the dominant *Lantana* taxa in the areas before releasing the insects on the plots. *Ocotoma scabripennis*, *O. championi*, *Uroplata girardi*, *Uroplata* sp. and *Leptobyrsa decora* were released for the first time at Letaba. *O. scabripennis* and *U. girardi* are still multiplying and spreading at Margate on the Natal South Coast.

Australian acacias

The gall-forming insect *Trichilogaster acaciae-longifoliae* (Frogg.) (Hymenoptera: Pteromalidae) was bred on *Acacia longifolia* (Andr.) Willd. under quarantine conditions. The eggs are usually laid in young buds still covered by flower bracts, but may also be laid in the axils of branches and in young leaves. Although the flowers buds of the host plant are already present on the trees by November and December and are then attacked by *T. acaciae-longifoliae*, the tree does not flower before the following July to September. Galls are visible from the beginning of January.

A small group of adult gall-forming insects appears during March and April, but the majority develop only during November and December. Since *T. acaciae-longifoliae* breeds under quarantine conditions and develops on leaves and

branch axils, specificity trials can be carried out on young indigenous *Acacia* trees.

The seed-eating *Melanterius* spp. and *Diethusa* spp. (Coleoptera: Curculionidae) were imported as adult and immature insects and placed in quarantine. The immature insects pupated from January to May. Adults can be kept alive for over 6 months at varying temperatures of 15 °C (day) and 5 °C (night).

Oviposition takes place from the time the developing seeds have attained about half their normal size to the stage when the testa starts hardening. Development starts early in summer. It takes about eight weeks from the egg stages to the prepupal stages and the prepupal and pupal stages together last about six to 14 weeks. There is a period of dormancy of about seven months during the adult stage.

INSECTS IN STORED PRODUCTS

Pirimiphos methyl, which gave good results last year as a grain protectant in bulk maize, was tested this year for post-fumigation protection of bag stacks. The entire grain depot at Dirkiesrus was sprayed with the preparation at four weekly intervals after fumigation. At the first spraying 3 g of active ingredient was applied per square metre, to insure an adequate precipitation. One and a half g per square metre was then applied to compensate for the breakdown of the poison on the sprayed surfaces.

A similar depot at Gemsbok Flats was sprayed with mercaptothion for comparative purposes at three g per square metre. The depot at Gemsbok Flats had to be fumigated again four months after the first fumigation, and was already reinfested by the end of the experiment (six months). The Dirkiesrus Depot remained uninfested. Residues of the poison that penetrated the bags were only 0,7 mg/kg on average, which is a tenth of the World Health Organisation's tolerance limit of 7 mg/kg.

A method developed in Israel for fumigating grain with methyl bromide in grain silos not equipped with gas circulation equipment was tested locally. This method boils down to the administration of methyl bromide together with carbonic acid gas so that the methyl bromide gas penetrates to all parts of the silo tube. On its own methyl bromide does not penetrate more than six metres into the grain pile.

If this method proves successful it will have several advantages. Firstly, it will cut out the turning costs involved in fumigating with phosphine gas. Turning costs amount to about R1 000 for a single silo tube with a 4 000 t capacity. Furthermore, a good fumigation technique would be available should insects develop resistance to phosphine gas.

Good progress was made during the year under review with obtaining basic reaction data on susceptible races of *Tribolium castaneum* and *T. confusum*. Basic reaction data for the following

preparations are now available: Lindane, bromophos, chlorpyrifos methyl, tetra-chlorvinphos, mercaptothion, mercaptothion plus triphenyl phosphate, pirimiphos methyl, phoxim, diazinon and fenitrothion. Data on the following preparations have yet to be obtained: methacriphos, dichlorvos, jodfenphos, natural pyrethrins plus piperonyl butoxide and permethrin. This data is required to calculate the degree of resistance of veld insects to the preparations in question.

Insect races have already been collected from over 100 different localities and it is hoped to start testing these insects soon for resistance to the above-mentioned poisons.

BEE RESEARCH

Studies of the melliferous flora of South Africa were continued and many new honey samples were obtained. A number of drone congregation sites were discovered on the Pretoria University's farm and in the vicinity, and a long series of experiments on the interaction between the two subspecies of South African honeybees was undertaken. This research has shown how the natural distribution of the two subspecies is maintained and has thrown much light on the biological characteristics of the *adansonii* bee that are of importance to bee breeding and management.

Breeding

With the limited material forming the basis of selection of the three lines of bees on Robben island, it can be expected that progress towards improvement by selection within these lines will level off. It is at this stage that additional material should ideally be brought into the programme. Characteristics that were wanting in the original gene pool of the present lines should be sought and selected for in new material for ultimate combination into one line. With the present staff shortage any expansion in the breeding programme to this effect is impossible.

It should be mentioned that although there is this levelling off of selection benefits, the maintaining of these lines at the same standard involves full selection pressure in their propagation. This is because of the phenomenon known as homeostasis, which implies that a selected population will tend to revert to its 'wild' state if the selection pressure is reduced or removed.

Disease

The unique brood nosema disease which was originally discovered in Pretoria and which appeared to be confined to this area, has now been found in the Tzaneen area.

Pollination

The results of previous work on pollination in apples indicated that the increasing use of hedgerow planting systems, might possibly cause

some problems in cross-pollination. The reason for this was because studies showed that honey-bees tended to work in rows rather than across rows in ordinary orchards i.e. not hedgerow type orchards. A study was undertaken and initially it would appear as if this is not as serious as originally suspected. It would be advisable to repeat the work to confirm these preliminary findings.

Lucerne pollination cage experiments were started at Oudtshoorn. Four treatments, namely, cages with Cape bees, cages with Transvaal bees, cages with no insect pollinators and open field control were used.

The preliminary results show very little difference between the two honey-bee treatments, while improved results were obtained from the open treatment. The open treatment was served by all the natural pollinators, plus the surplus of field bees from the cage treatments, because the hives here were arranged so that the bees could work either into the cage or to the outside. All insect treatments were considerably better than the no insect controls. It is planned to repeat the work this coming year.

Conservation

The sanctuaries of the preservation of the Cape honey-bee *Apis mellifera capensis* were visited and samples of the bees collected. Strong, roughly made nesting boxes have been made to be placed in areas such as the Cape Point Nature Reserve where nesting sites seem to be a limiting factor. In this way it is hoped to increase the natural populations.

POLLINATION OF LUCERNE

A small xylocopid, *Xylocopa caffrariae*, was found to be the most numerous solitary bee working on lucerne flowers at the Oudtshoorn Experimental Farm in January 1978. Other potentially important solitary bees seen were *Anthophora* sp. and *Megachile* sp., both very infrequent. *Xylocopa* is not recorded in the literature as an important pollinator of lucerne, however.

X. caffrariae was found to be fairly uniformly spread through the lucerne, which suggests that it forages over greater distances than have been observed for *Megachile pacifica*, a commercially important lucerne pollinator in North America and Europe.

Another xylocopid at Oudtshoorn is *X. caffra*, which has been observed working on lucerne and on *Acacia karroo*. *X. sicheli*, which is apparently of no importance as a lucerne pollinator, is also present at the Oudtshoorn Experimental Farm.

FOREST AND TIMBER INSECTS

Defoliators

Although *Nudaurelia cytherea* did occur in considerable numbers in plantations in the Western and Southern Cape during the past year, no large-scale defoliation was reported and no control was carried out. Recent surveys have shown, however, that damage to pine trees can be expected in the Western Cape during the coming season. A sampling system was adopted by foresters in order to determine the expected defoliation of pines in advance so that timely control measures can be applied.

Tolna limula, a new forest pest that appeared only last year (and was reported in the previous report as a probable *Anua* species), was responsible for the complete defoliation of 80 ha of *P. radiata* in the Van Staden Pass State Forest near Uitenhage. An investigation during November 1977 showed that the insect is endemic virtually throughout the entire Loerie-Longmore-Otterford plantations. An aerial spraying with a suspension of *Bacillus thuringiensis* was successfully applied against the pest at the Van Stadens forest plantation during November 1977.

After aerial spraying for larvae of the pine emperor moth *Nudaurelia cytherea clarki* it was found that Ripcord, at a dosage of 50 g of active ingredient to 30 l of water per ha, killed about 90 per cent of the larvae within the first 24 hours and almost all the larvae after three days. A spraying of 25 g of active ingredient per ha was then carried out to determine the effect on the larvae.

The willow tree emperor moth *Gonimbrasia tyrrhea* again defoliated thorn trees in the Little Karoo and the Langkloof and the insect was also reported as a pest on *Euclea* and *Rhus* shrubs used for blown sand reclamation in the Elands Bay area.

Bark beetles

The European bark beetle, previously reported as probably being an *Ips* species, has been identified as *Orthotomicus erosus*. The beetle has also been found in the Southern Cape and its distribution now extends from the Cedarberg State Forest to the Longmore State Forest near Port Elizabeth. In the Western Cape attacks by the beetle are confined mainly to younger stands in the 5-15 year age group, but it has now been found that older and adult trees are also attacked.

The incidence of the pest was sporadic at first and it was considered to be of secondary importance, but recent observations have shown that, because of its numbers, the beetle is also capable of attacking and killing healthy trees. The damage is aggravated because the beetle transmits a blue fungus which discolours the wood and is apparently capable of killing the tree by itself, to the cambium; damage of this kind has occurred on *P. pinaster* at Tokai and on *P. radiata* at the Jonkersberg State Forest and in the Great Brak River and Woodfield plantations (George district).

The beetle was also found on *P. canariensis* and *P. halepensis* and is apparently capable of attacking all pine species. Further research on the insect is receiving top priority.

The Black Pine aphid, *Cinara cronartii*

In view of the promising results of the 1976/77 population study of the black pine aphid in the Eastern Transvaal, using Moericke traps, the survey was extended on a nation-wide basis to 33 localities in an area stretching from Louis Trichardt in the north to Stutterheim in the South. A report on the survey will be produced next year.

A method of sampling aphids in tall pine trees was also developed. This entails determining the rate of honeydew secretion, which depends on the population density of the aphids. The honeydew droplets are gathered on index cards which are treated with an indicator substance, bromocresol-green and then placed on the ground under the trees at random.

Trials to determine possible timber loss in pine compartments as a result of aphid damage were also started. A trial was laid out at the Witwater State Forest, near White River, in which 180 *Pinus taeda* trees will be kept free from aphids each year by means of stem injections of phosphamidon at a concentration of 100 ppm (active ingredient of the poison to the timber volume of the tree). This treatment provides complete control of aphids within 10 days. Annual measurements of the wood increment in the treated and untreated trees will be carried out.

The regular pine aphid counts carried out on pines of the species *Pinus taeda*, *P. elliottii* and *P. patula* at the Frankfort and Long Tom Pass forest stations have shown that the pine aphid has a definite preference for *P. taeda*. The aphids also appear much earlier in the season at the Frankfort forest station than at Long Tom Pass. The fact that the former station lies at a lower altitude and is therefore warmer may explain this.

A trial has been started at the nursery at Cedarburg in Pietermaritzburg in co-operation with Mr R. Borthwick of the Wattle Research Station. The aim is to determine the relative susceptibility of young trees of *P. taeda*, *P. elliottii* and *P. patula* to pine aphids, and the effect of vigorous and poor growth of the trees on the intensity of the aphid attack. This will be reported on next year.

Pine woolly aphid - a new pest of pines

A new aphid pest of pines appeared in South Africa during the past year, but has not been found in pine plantations so far. The insect belongs to the genus *Pineus*, family *Adelgidae*; the species name is as yet uncertain. The English popular name is "pine woolly aphid", a suitable Afrikaans equivalent being "dennebloedluis". *Pineus* sp. is as yet confined to the Pretoria area, where it is responsible for severe attacks, chiefly of *Pinus halepensis*.

Although some of these trees, which are grown as ornamentals or windbreaks in this area, have died, it has not yet been established whether the aphid is the cause of these deaths or not. This insect is also causing considerable problems with regard to control. Not only is the spraying of a few big trees impractical, but trials carried out on infested nursery trees using dimethoate, vamidothion and pirimicarb at dosages of 0,05 to 0,1 % active ingredient, applied as cover sprays, provided very poor control.

Stem injections with dimethoate, vamidothion, isothioate and phosphamidon at 100 to 150 parts per million provided over a 60 per cent control and such treatments are probably the most practical solution.

Timber insects

Overseas techniques for breeding timber insects are now being successfully applied and single cultures of over 3 000 *Hylotrupes bajulus* are bred annually. *Luctus brunneus* are being successfully bred, either on starchy oak or on dog biscuits. The establishment of *Cryptotermes brevis* in pines is continuing, but is proceeding slowly on account of the insect's breeding capacity. The use of *Porotermes africanus* in test plots based on those at Pienaars River is still being investigated.

An experimental pressure cylinder was transferred to the South African Forest Research Institute in Pretoria, which will now undertake research on all aspects concerned with the mechanics of timber processing; entomological matters will still be dealt with by the unit at Rosebank. Discussions were held with several bodies, including the Department of Forestry, on matters such as timber processing, including new regulations.

ZOOLOGICAL PESTS

National Collection of Nematodes

The nematode collection was expanded to 13 824 microscope slides representing a total of 61 700 specimens. Five collecting trips were undertaken, during which a number of nematodes were obtained for the collection. Taxonomic studies of additional material of the genus *Scutellonema* and the genus *Rotylenchulus* were completed. Four previously described species were reported for the first time in South Africa. The Government of Fiji is being assisted with the identification of a few genera of spiral nematodes.

About 1 600 routine soil, root and seed samples were processed during the year under review. The Division of Plant and Seed Control contributed 1 071 and the rest came from farmers, private concerns and Departmental bodies.

Nematodes in cotton

During the year under review the trial in which four nematocides, namely carbofuran, Nemacur, Fumazone and ethylene bromide, were

tested at Jan Kempdorp for the control of nematodes on cotton was repeated. The best results were obtained with Nemacur, although ethylene bromide and carbofuran resulted in only slightly poorer yields.

Two rotational cropping systems (followed over a period of six seasons) namely continuous plantings of (1) oats and cotton and (2) wheat, maize, fallow, groundnuts, oats and cotton, both resulted in higher yields than the control and compared favourably in respect of yield with the Fumazone treatment.

A further control treatment was carried out at Groblersdal in co-operation with a co-operative agricultural society and the following preparations were included: carbofuran, Vydate, Temik, Dacamox and Thimet. Carbofuran produced the best results and differed significantly from the control.

The F2 generations from the crossing of six different cotton cultivars with the resistant cultivar Auburn 623 RNR were tested for resistance to *Meloidogyne incognita*.

The plant-parasitic nematodes obtained from a survey carried out at the Loskop Irrigation Scheme have been identified to the species level.

Potato cyst nematode

The chemical treatment of infested soil with Dazomet and DD caused the population density of the nematodes (in terms of the number of live eggs per gram of soil) to drop by an average of 52 %. In untreated soil the population density increased by an average of 68 %. About twice the quantity of potatoes was harvested from the treated soil as from the untreated soil - i.e. the crop increase was 93,5 %.

Virus transmission by nematodes

During the past year attempts to establish cultures of potential virus vector nematode species under glasshouse conditions were continued. The indications are that fig is a more suitable host plant than grapevine for *Xiphinema index*.

Nematode vectors of viruses in vines

Investigations into the use of DD soil fumigant against *Xiphinema index*, the nematode vector of grapevine fanleaf virus, have been continued. Figures obtained over the past year indicate that some recovery of the *X. index* populations had taken place, but that they were still significantly below the prefumigation levels. Population levels of other *Xiphinema* spp. were similarly depressed.

National collection of Arachnida

A total of 400 identifications of 130 mite species were carried out. Thirty plant parasitic species were included. Mite accessions amounted to 645 during the year under review and 195 specimens were collected from agricultural crops

and wild plants. Spider accessions amounted to 815.

Cotton mites

Surveys of red spider mite populations were carried out in the Groblersdal area during the 1977/78 season. *Tetranychus cinnabarinus* populations started occurring from the beginning of January and spraying was carried out with triazophos. Effective control was obtained and the pest started decreasing gradually during March again.

Pesticides were evaluated in the laboratories. Nineteen that performed well underwent field evaluation at the Loskop Experimental Farm during the 1977/78 season. The population increment in the trial plots was stimulated by the use of insecticides, namely carbaryl, DDT and tetrachlorvinphos, which are known for their mite stimulating properties. At the same time these insecticides controlled the bollworm complex that attacks cotton. Before rucksack spraying was started researchers made sure that there was a degree of homogeneous infestation in all the trial plots.

It was evident from regular determinations of populations and cotton crop masses that about seven of the 19 preparations, namely accophos, profenphos, fenpropanate, amitraz, dicofol, 2-(acetyloxy) (3-dedecyl-1,4-naphthalene dione and the standard triazophos were outstanding. These preparations will be repeated in a field trial next season.

The adverse effect of leaf damage on the lint quality of cotton was demonstrated during a field trial at Rust de Winter, where 50 % and 100 % damage was artificially inflicted on the leaves of a number of full-grown plants late in the season. The micronaire, maturity ratio and fineness of the cotton lint decrease as the amount of leaf damage increases.

In order to test the resistance of mites to pesticides, samples of the mite population concerned were taken from two areas, namely Rust de Winter and Groblersdal, where the mite pest has been controlled with triazofos for the past few seasons. After two generations the samples were compared with a susceptible laboratory culture by means of a probit analysis and no resistance to the organic phosphate in question proved to be present in these areas.

Two-spotted spider mites

Tetranychus urticae, hitherto unrecorded in the Western Cape, was identified in two Paarl nurseries where it caused damage to chrysanthemums. The spider mites were also detected at Ottery on the Cape Flats.

Rodents

Efficacy determinations were carried out with 0,005 % difacinone (an indane dione derivate) on

Tatera brantsii in the laboratory. Good results were obtained - 100 % mortality with 3 and 4 day applications.

Palatability trials in which poison bait was tested against unpoisoned baits showed the following results:

Chlorfacinone and zinc phosphide	significant preference for poisoned maize
Difacinone and warfarin	no significant differences
Warfarin + sulfaquinoxaline	significant preference for unpoisoned maize

The rejection of the poisoned maize in the last case may be ascribed to the addition of sulfaquinoxaline, which did not even have the advantage of increasing the efficacy of warfarin.

PLANT PATHOLOGY

Mycology

Fungus identifications

During an unusually busy year over 3 000 fungi were identified for workers at other Institutes and Regions of the Department, University personnel and workers in the private sector. The great majority of these were plant pathogens or were associated in some way with plants.

Among the important pathogens identified were: *Sclerotinia sclerotiorum* on soya-beans and sunflower in various localities in the Transvaal; *Cercospora kikuchii* and *Peronospora manshurica* on soya-beans in the Transvaal; *Phytophthora megasperma* on lucerne from various localities and *Peronospora trifolii* on this host from Ermelo; *Thielaviopsis basicola* on groundnuts from Vaalharts; *Embellisia allii* on garlic bulb scales and *Stemphylium lycopersici* on tomatoes from Pretoria.

Botryodiplodia theobromae was found on cotton roots from Letsitele and *Ramularia areola* on cotton leaves from Messina and Komatipoort. *Fusarium decemcellulare* was identified on sunflowers from Natal, the northern Free State and North-Western Transvaal. *Diplodia macrospora* was found on maize at Bethlehem, Orange Free State, and Hillcrest, Natal.

Toxigenic fungi in stock feeds

Research on toxin-producing fungi in stock feeds continued with the examination of 60 samples of feeds. *Fusarium moniliforme* was found to be the commonest species with toxigenic potential. *Aspergillus clavatus*, which can cause fatal tremors in cattle, was found in a sample of sorghum bean residue. Ergot, *Claviceps* sp., was identified in two samples of hay. *Pithomyces chartarum* was found on a number of different samples. Of 45 isolates obtained, 8 were tested for toxigenic ability in pure culture.

Aspergillus clavatus was grown in pure culture on 240 kg of solid medium. This material

was used for toxicological tests and extraction of the tremorgenic toxin by workers of the Toxicology Section of the Veterinary Research Institute.

Seed-borne fungi

A preliminary study of fungi that cause cob-rot of maize in the Transvaal was completed. At five different localities, seeds from rotten cobs of 125 maize hybrids were examined. *Fusarium moniliforme* was the commonest fungus. *Fusarium graminearum* and *Diplodia maydis* occurred less frequently. *Nigrospora oryzae*, *Helminthosporium carbonum* and *Cladosporium herbarum* occurred very infrequently in these kernels.

Seeds of various species of pasture grasses were examined. Few pathogens were present on kikuyu *Pennisetum clandestinum* seed, and these were mostly *Fusarium moniliforme*. On seeds of buffalo grass *Cenchrus ciliaris* and rye grass *Lolium multiflorum* species of *Drechslera* and *Phoma sorghina* were the most important pathogens but saprophytes such as *Alternaria alternata* and *Cladosporium cladosporioides* occurred in large numbers.

Seeds of various bean varieties were examined for seed-borne pathogens; *Colletotrichum lindemuthianum* was found on four samples only. *Isariopsis griseola* was identified on one sample of seed from Barberton.

Taxonomy and mycoflora survey

A study of the species of *Colletotrichum* in South Africa was continued. Collections of economically important as well as indigenous plants showing symptoms attributable to infection by these fungi were made in the Pretoria area and around Nelspruit. A total of 13 species on 70 host plants have been found to date. Studies on the comparative morphology and characteristics in pure culture have been started on some of the species and isolates.

A survey of the fungi that cause diseases of lucerne in South Africa was started. The identity of pathogens on leaves, stems and roots and the relative frequency of occurrence of these pathogens in different lucerne production areas are being determined.

During the past season the four main lucerne growing areas in the Transvaal, one in the Eastern Cape Province and one in the North-Eastern Orange Free State were surveyed. Most of the pathogens of lucerne known to occur in the United States of America were found in these areas. *Leptosphaeria briosiana*, the fungus causing pepperspots of lucerne, proved to be the most common and widely distributed leaf pathogen.

Root rot caused by *Fusarium* spp. was found in many of the fields examined. This survey will be extended to cover other areas during the coming summer season.

Curatorial work

A total of 6 specimens were sent on loan to other institutions, and the period of loan of 27 other specimens was extended for one worker in the United States of America.

One fungus culture was received as a gift from an overseas worker, and 6 cultures were sent to overseas institutes for identification.

A total of 269 dried fungus specimens were deposited in the Herbarium, bringing the total number of specimens to 45 362.

Phytophthora cinnamomi Root rot

A survey of rivers of the Western Cape during midsummer (1977-78) has shown that many of these rivers are infested with *Phytophthora cinnamomi* and other *Phytophthora* spp. at the time of heaviest use of the waters for irrigation.

Monthly sampling of the Berg and Eerste Rivers throughout last year has shown that *Phytophthora* spp. are present in these rivers at all times of the year. Water filtration and treatment systems that may provide *Phytophthora*-free water for irrigation purposes, especially for nurseries and plant improvement schemes, are being tested.

The control of *Phytophthora* root and collar rot of cultivated proteas is being investigated. A pamphlet containing information about this disease problem and how to control it has been distributed to protea growers throughout the Republic.

Bacterial diseases in dry beans

The importance of seed-borne bacterial diseases in dry bean production in South Africa was again evident from an investigation of 74 plant samples obtained from farms in the most important bean production areas. These samples were all infected with one of the bacterial or halo blights. The fungus *Colletotrichum lindemuthianum* was also isolated from several samples.

Satisfactory progress is being made with the purification of bean seed from bacterial and fungus pathogens. During the past year the Plant Protection Research Institute completed the purification of the seed of a further eight bean cultivars. Good progress was made with the multiplication of this seed by other bodies in areas that are free from bacterial pathogens and several hundred kilograms of clean seed of some cultivars is already available. The seed is undergoing further multiplication at present.

Crown gall

The search for methods of controlling the crown gall problem on grapes in the Orange River Valley continues. Chemotherapy, thermotherapy, biological control and host resistance are being investigated.

A new biotype of *Agrobacterium tumefaciens*, the crown gall bacterium, has been found, making biological control studies even more complicated. This third biotype appears to be identical to the

one reported on grapevines in Greece. Avirulent South African isolates are being screened for antibiotic production to determine whether these isolates can be used for biological control. Grapevine cultivars are being tested for resistance to crown gall.

Virus diseases in vines

A possible viral cause is being sought for the death of young plantings of the red wine grape cultivars Shiraz and Tinta Barrocca.

Preliminary results of an investigation into the possibility of eliminating vine fanleaf virus in old vineyard soils by applying D-D soil fumigation against its nematode vector, *Xiphinema index*, indicate that new plantings may become re-infected within a single season after shallow fumigation. On the other hand, no infections have yet been observed with deep fumigation. The trial is being continued.

The results of controlled glasshouse trials to determine the connection between the re-infection of new plantings with vine fanleaf virus and the presence of *Xiphinema index* populations have so far proved negative. No virus could be traced in *X. index* samples collected in the root zones of re-infected vines.

Investigations into improved techniques for tracing vine fanleaf virus in order to overcome the effect of the seasons on virus indexing with herbaceous test plants showed that linking the purified gamma globulin fraction to an enzyme makes *direct* immunological tracing of vine fanleaf virus possible throughout the growing season in affected Colombard vines. Because the reaction is a delicate one it is best to test batch samples from which indications of the active spread of vine fanleaf virus can be obtained. This has important economic implications when decisions are taken on soil treatments during the replanting of infected old vineyard soils. This investigation is being continued.

Problems encountered with the successful elimination of heat-stable races of vine leafroll virus led to the successful adoption of a micro-grafting technique by means of which vine growing points less than 1 mm in size can be grafted *in vitro* onto virus-free seedlings after a heat treatment at 38 °C. (Photograph 1). This investigation is proceeding.

A study of *Pyronia veitchii* as an indicator for tracing virus diseases in pomes and drupes has shown that *P. veitchii* is very sensitive to certain biological races of apple chlorotic leafspot virus which occur in local plantings. The series of international indicators available will have to be adapted in order to obtain reliable information on the virus status of local material, especially where there are signs that apple chlorotic leafspot virus can spread naturally - an aspect which is being given high priority.

Results of indexing drupe cultivars, especially cherry and plum cultivars, indicate that there is a widespread incidence of the pollen-borne viruses

Prunus necrotic ringspot and prune dwarf, and underline the need for SA Super plants, so that commercial plantings can be protected from progressive deterioration as a result of these viruses. The use of the enzyme-bound antiserum tracing technique is being investigated at present; it will be applied to these viruses as well.

NITROGEN FIXATION

Legume inoculants

Continuous rises in the prices of nitrogenous fertiliser have led to an enormous increase in interest in legume crops capable of the biological fixing of atmospheric nitrogen by means of *Rhizobium* bacteria. However, this process can only be used if suitable *Rhizobium*-legume combinations for the various agricultural regions can be found.

During the past year the Nitrogen Fixing Unit of the Plant Protection Research Institute therefore had to supply effective *Rhizobium* races for numerous new legumes considered promising and used in trials by research bodies. These races were either locally isolated or obtained from overseas.

Strict control over the quality of inoculants produced locally by private concerns is now bearing fruit. Whereas the quality of South African legume inoculants was extremely poor a decade ago, it is now generally acknowledged, even overseas, that locally produced inoculants are among the best in the world. The accompanying table shows the exceptionally high quality of approved inoculants marketed by inoculant manufacturers in South Africa during the past year.

Since it is agreed that good *Rhizobium* inoculant is one of the most important requirements for the successful cultivation of legumes, the application of quality control will be continued.

Quality of 200 batches of inoculant* approved for marketing in 1977/78

Number of <i>Rhizobium</i> cells per g of peat	Batches of inoculant	% of the total number of batches
5,0 - 9,99 x 10 ⁸	53	26,5
1,0 - 4,99 x 10 ⁹	132	66,0
5,0 x 10 ⁹	15	7,5

* About 150 000 units of inoculant were marketed

Free-living nitrogen-fixing bacteria

The incidence of free-living nitrogen-fixing bacteria was determined in the root rhizospheres of sugar-cane, maize, grain sorghum and 23 grasses which were examined. These bacteria appear to be widespread in South African soils.

Research is being undertaken to determine what the contribution of these diazotrophic bacteria is to the nitrogen economy of South African soils. It is already clear that the contribution of these

bacteria cannot be compared with legume-*Rhizobium*-symbiosis, and it appears doubtful whether these bacteria could ever play an important part in intensive agricultural practices.

PHYTOSANITARY SERVICES

A total of 135 samples of imported plant material were received; 51 were found to be infested with injurious organisms. Preliminary indexing results showed virus infection in five of these samples.

In the course of the application of the Orchard Cleansing Act, 265 samples of fruit trees cuttings were examined for the presence of scale insects, particularly pernicious scale *Quadraspidiotus perniciosus* and grey scale *Diaspidiotus africanus*.

Following the laboratory examination of samples from 12 consignments of export fruit, 7 were rejected owing to infestation by pernicious scale, codling moth *Laspyrisia pomonella* and snout beetle *Phlyctinus callosus*. Eighty soil samples from several sources have been examined microscopically for the presence of plant-parasitic nematodes. A further 16 soil samples from the SA Plant Improvement Organisation (SAPO) which were examined revealed none of the virus-carrying nematode species.

Good progress was made with the elimination of virus infection in pome and drupe cultivars and grape cultivars. Scion and rootstock cultivars of the following crops are available at present for use as foundation material: apples (11), pears (10), plums/prunes (9), almonds (2), apricots (7), peaches (8), cherries (10), wine grapes (19) and grape rootstocks (12).

The availability of this material enables the plant multiplication organisations, SAPO and the KWV, to make propagating material available to the South African nursery industry for the production of SA Super plants. This improved propagating material is expected to increase production and quality by up to 30 per cent.

QUARANTINE FACILITIES

Development

Good progress has been made and quarantine measures are already applied to imported seed and plants and to vegetative propagating material that does not receive attention elsewhere. A glasshouse with 11 rooms was completed and the ancillary building, which is nearing completion, should be taken into use soon.

A fibreglass greenhouse is already being used with great success, and a second, intended for imported pine propagating material, should be put into operation soon.

Quarantine

The existing facilities were used for 391 seed imports, which were subjected to quarantine. The results are given in the accompanying table.

New record of plant diseases

Sclerotium rolfsii was found for the first time in South Africa, on the following crops, which were being kept in quarantine at Buffelspoort: barley, oats, wheat, rye and *Mentha piperita*. Tests are being carried out to determine whether the organism can be regarded as a pathogen of these plants.

In a planting of the national sunflower cultivar trial, which included three imported cultivars in quarantine, a few plants with typical *Rhizopus* head rot symptoms were observed, but it was not possible to isolate any pathogens from the tissue. This disease has probably also been observed in the Free State in sunflower plantings. Other diseases also thought to occur in South Africa include *Phoma* black leg on sunflowers in Natal and *Sclerotinia* wilt on soya-beans, especially in the Western Transvaal. The possible incidence of these diseases is receiving attention.

Data bank

Considerable progress has been made with the extension and maintenance of a data bank of plant pathogens that occur both overseas and in South Africa. This information, which is decisive in determining phytosanitary import requirements and quarantine measures, includes the following facts: the scientific and popular names and synonyms of plant pathogens and those of their host plants, information on distribution, noxiousness, tracing techniques, preventive measures and control. Plant diseases are being recorded in the data bank at present.

TECHNICAL ADVICE

Registration of pesticides and fungicides

Some 600 applications for registration and amendments to existing registrations of insecticides, fungicides and rodenticides were considered, and the preparations were recommended for registration under Act 36 of 1947.

The annual Departmental communication "A Guide to the Use of Pesticides and Fungicides in South Africa" (205 pages) was extended and updated and appeared during August 1977.

Standing committee on agricultural remedies (INDAC)

Six meetings of the Committee took place during the year. During this period members were reappointed for a further period of three years. At present the Committee comprises four officers of the Department of Agricultural Technical Services, three officers of the Department of Health and one member each of the Veterinary and Medical Faculties of the Universities of Pretoria and Cape Town. The Registrar appointed in terms of Act 36/1947 is an *ex officio* member of INDAC.

Strains planted in quarantine

Crop	Number	Released
Spinach beet (<i>Beta vulgaris</i>)	4	Undergoing testing
Garden bean (<i>Phaseolus vulgaris</i>)	2	2
Broad bean (<i>Vicia faba</i>)	13	Planted during 1976/77, still undergoing testing
<i>Cavalia gladiata</i>	1	Undergoing testing
<i>Cavalia bonariensis</i>	1	Undergoing testing
Eggplant (<i>Solanum melongena</i>)	1	1
Pea (<i>Pisum sativum</i>)	19	7, (11 undergoing testing)
Barley (<i>Hordeum vulgare</i>)	9	8, (1 rejected)
Guar bean (<i>Cyamopsis tetragonoloba</i>)	1	Undergoing testing
Oats (<i>Avena sativa</i>)	2	2
Cotton (<i>Gossypium hirsutum</i>)	14	12, (2 rejected)
Wheat (<i>Triticum aestivum</i>)	143	8, (135 undergoing testing)
Wheat (<i>T. durum</i>)	4	Undergoing testing
Mentha (<i>Mentha piperita</i>)	2	Undergoing testing
Maize (<i>Zea mays</i>)	53	53
Peppers (<i>Capsicum minimum</i>)	1	Undergoing testing
Rye (<i>Secale cereale</i>)	2	2
Rice (<i>Oryza sativa</i>)	40	40
Soya-beans (<i>Glycine max.</i>)	9	9
Sunflower (<i>Helianthus annuus</i>)	53	47, (6 rejected)
Sorghum (<i>Sorghum sudanense</i>)	8	8
Ochra (<i>Hibiscus esculentus</i>)	2	2
Safflower (<i>Carthamus tinctorius</i>)	7	7
Total	391	208 released

The coming into operation of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Amendment Act (Act 24 of 1977), as well as the laying down of maximum residual periods for pesticide residues in food products in terms of the Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972) made it necessary for INDAC to draw up an information brochure to redirect the general public's attention to legislation that has to be taken into account in the application of pesticides.

As mentioned in the 1976/77 annual report, the investigation into the misuse of dieldrin was continued. A report submitted by an oil company in this respect was unsatisfactory, and the Committee considered the complete withdrawal of formulations susceptible to misuse. The considerable increase in cases of stock poisoning observed by the Veterinary Research Institute (33 separate cases so far during the 1977/78 season), as well as the alarming increase in the percentage of dairy and meat products showing residual levels exceeding the maximum residual level (36 % of all dairy products; 53 % beef; 27 % pork; 13 % mutton) determined by the Plant Protection Research Institute, secured further support for the above-mentioned view. The Committee also noted that there are at present between two and seven alternative registered products for the most important applications of dieldrin and that it is only for a few sporadic pests that there is no alternative. The opinion was expressed that as soon as it becomes known in the trade that dieldrin will be withdrawn for these purposes applications for registration can be expected. Only in the case of the control of beetle larvae in sugar-cane are there no prospects of finding alternative preparations. There is, however, every possibility that in these cases dieldrin could be mixed with a suitable weedkiller,

which would eliminate the dangers of misuse. In view of the above-mentioned, INDAC recommended that the registration of dieldrin wettable powder and emulsifiable concentrate as well as aldrin wettable powder be withdrawn as soon as possible.

The dangers inherent in applying pesticides by means of portable ultra-low volume spraying equipment were mentioned in the previous report. On the recommendation INDAC, the Department of Health instructed the National Research Institute for Occupational Diseases to evaluate the inhalation hazards of the droplet spectrum of the above-mentioned equipment.

At the request of the Animal and Dairy Science Research Institute, INDAC considered the toxicological hazards of mixing poultry manure into stock feed. In the opinion of the Committee the danger of transmitting medical and other stock remedies in the manure is minimal and there is no justification from a toxicological point of view for discontinuing the use of poultry manure in this application.

The agricultural industry is showing increasing interest in the use of antibiotics to control bacterial diseases of horticultural and field crops. In view of the problems encountered with antibiotics in human medicine, INDAC considers the use for agricultural purposes of antibiotics used in the medical field an undesirable practice and is not prepared to consider applications for registration of this kind in future.

In terms of the Animal Diseases and Parasites Act (Act 13 of 1956) sheep scab is defined as a notifiable disease for which quarantine is compulsory. Since the withdrawal in 1971 of BHC for the control of the mite that causes this disease, various preparations registered for itch mite and other pests have been used for this purpose, but

with little success. The Committee has consequently recommended that, with effect from 1 January 1979, only diazinon and lindane be permitted for the control of sheep scab.

LOCUST CONTROL

Tropical migratory locusts

There was a minor outbreak of the tropical migratory locust, *Locusta migratoria migratorioides* in the Bothaville, Wesselsbron, Bultfontein and Theunissen districts. Swarms occurred on isolated farms only, but dense swarms formed. The first hoppers were controlled in the Wesselsbron district on 21 October 1977. A control unit spent a few days at the Sand-Vet River irrigation plots giving assistance with control measures. The majority of swarms were controlled by the farmers themselves. Population numbers in the surrounding districts of the North-Eastern Free State were relatively high.

Brown locusts

The 1977/78 campaign against the brown locust *Locustana pardalina* (Walker) was conducted on a fairly small scale, except in the south-western part of the Prieska district, where large and fast-moving flier swarms formed early in January 1978. Some of these flier swarms reached the Britstown, Griquatown, Hopetown and Philipstown districts.

Control measures were started in the Carnarvon district on 4 October 1977 and were rapidly extended to the Kenhardt, Prieska, Griquatown, Hopetown, Philipstown, Britstown and Victoria West districts. The last control unit was withdrawn towards the end of April 1978.

The highlight of the campaign occurred early in January 1978, when 47 control units were in the

field. From February to April 1978 a small-scale campaign was waged against second generation swarms. The entire eastern and southern parts of the Karoo were free from swarms and population numbers dropped considerably in comparison with the previous season.

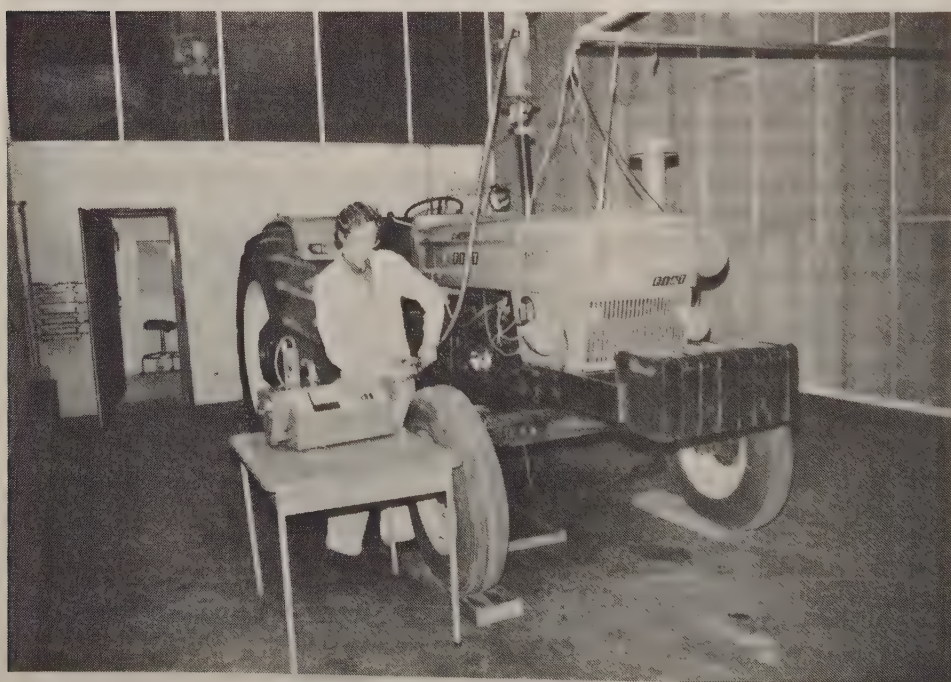
A total of 10 435 hopper swarms and 1 874 flier swarms were destroyed, and 92 250 kg of 7% Gamma BHC was used. A distance of 228 765 kilometres was covered, and the sum of R37 117 paid in wages. The total cost of poison, wages and transport amounted to R131 566.

Red locust control service

The Pretoria based Red Locust Control Service continued to monitor the red locust, *Nomadacris septemfasciata*, throughout southern Africa and to provide information to neighbouring countries.

The red locust position in southern Africa remained quiet during the year. Although no reports of locusts were received from Mozambique, a 60 ha medium density concentration of fledgling locusts was reported from the middle Shire Valley of Malawi. No damage was, however, reported.

In East Africa the red locust position continued to deteriorate, with the Rukwa Valley of South-West Tanzania, a notorious swarm producer in the past, becoming active and producing emigrant swarms for the first time in 20 years. At least two swarms are reported to have flown onto the nearby Ufipa Plateau in early May 1978. Other unchecked swarm escapes were also reported from the top end of Lake Tanzania, near Kigoma, but are believed to have had their origins in another outbreak area, the Malagarasi Area. No control operations were carried out in these areas.



The first tractor that was tested at the tractor testing centre of the Division of Agricultural Engineering

In the Wembere Area of Central Tanzania, which has been a constant source of swarms over past years, chemical control of hopper bands by the International Red Locust Control Organisation of Central Africa successfully checked any further outbreaks. But it is understood that large populations of scattered locusts nevertheless developed and will require attention in the forthcoming dry season.

ELECTRON MICROSCOPE UNIT

This unit is now in full swing. During the past year 37 persons made use of the facilities; 70 % of the work was done with the scanning electron microscope. In addition to the Microbiology Section of the Institute, virtually every section makes use of the facilities.

Services were also rendered to the Division of Soil Protection, the Soil and Irrigation Research Institute, the Botanical and Horticultural Research Institutes, the Transvaal Region, the CSIR and the University of Pretoria. This entailed the taking and development of 2 100 micrographs.

AGRICULTURAL ENGINEERING

The basic aim of the Division of Agricultural Engineering is to provide the engineering expertise necessary for the optimum utilisation of natural resources.

The work of the Division may be classified into seven sections:

- Agricultural mechanisation in plant production
- Agricultural mechanisation in livestock farming, with the emphasis on housing
- Processing, handling and storage of agricultural produce
- Water utilisation in agriculture, with the emphasis on irrigation engineering
- Engineering in relation to the conservation of natural resources
- Professional and technical services rendered to the Department of Agricultural Technical Services and other government organisations
- Advisory and educational services

In carrying out the functions of the Division, the staff are engaged in about 200 assignments, which can be divided into five categories:

- Testing - 30 %
- Research - 25 %
- Advisory services - 20 %
- Professional and technical services - 15 %
- Development - 10 %

LIAISON WITH THE PRIVATE SECTOR

The Division maintains close contact with manufacturers and distributors and other

organisations in the private sector which are concerned with agricultural engineering.

With this in mind, the Division prepared a carefully planned programme in 1972, designed to bring about close co-operation. This aim has since been realised and the agricultural industry has benefited in various ways. The most important committees that are active at present are the Tractor Liaison Committee, the Advisory Committee for the Testing of Agricultural Implements and Equipment, the Horticultural Tractor Industry Organisation and committees on irrigation equipment and milking equipment.

THE TESTING OF AGRICULTURAL MACHINERY AND EQUIPMENT

The official testing of agricultural machinery and equipment is one of the most important activities of the Division. Equipment available commercially is evaluated on the basis of performance, durability and other qualities. The test reports are published under the trade names of the products. Participation by manufacturers or dealers is voluntary and the Division makes its services available free of charge.

The following test reports were published during the year under review:

Planters	7691 - 7692
Drippers for irrigation	77051
Augers for handling grain	76101 - 76103
Row-crop forage harvesters	77141 - 77147
Disc and drum mowers	77132 - 77133
Centrifugal pumps	77001 - 77015
	77021 - 77029
	77033 - 77035
Stock scales	77041 - 77048

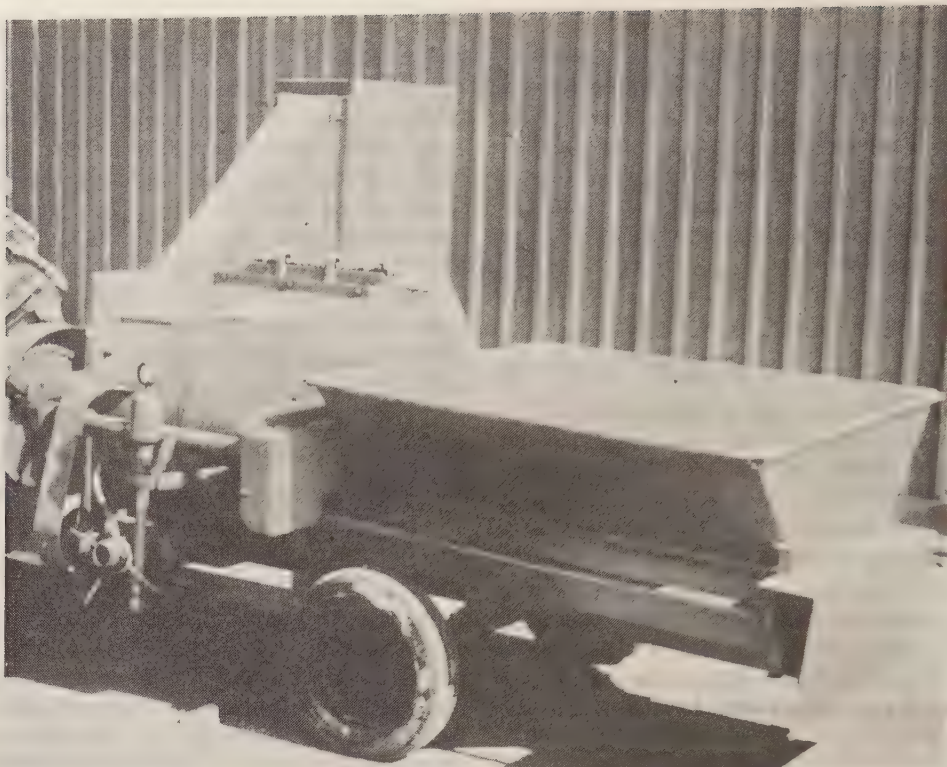
Test programmes at various stages of completion include programmes on stock scales, feed mixers, a feed mixer wagon, vertical batch mixers with a hand pump for liquid molasses, microjets for irrigation, orchard sprayers, hammer mills and pelleting machines.

AGRICULTURAL MECHANISATION: RESEARCH AND DEVELOPMENT

Quite apart from testing, a great deal of research and development on mechanisation is done in agriculture. The chief projects are discussed briefly below.

Tractor power testing centre

A modern testing complex has been built where the power of tractors and engines can be determined at a height of 400 m above sea-level, which is the height at which most agricultural machinery in South Africa works. As far as is known, this is the only testing centre of this kind in the world where tractors are tested at this height above sea-level.



The continuous mixer as adapted for the treatment of low-grade roughage with caustic soda



A neck clamp for large stock designed and built by the Division of Agricultural Engineering. Plans for the neck clamp are available

During the year under review the various mechanical and electronic components of the complex were installed and adjustments and modifications were made where necessary. A South African tractor test code was drawn up. It was based on the OECD test code and incorporates the ISO test requirements wherever possible.

The official testing of tractors has already been started and three tests have been completed.

An important aspect which was emphasised during the first tests was the vital role careful and accurate setting of the diesel pump plays in efficient performance of the engine, diesel fuel delivery and time - a matter which is largely overlooked. It was also clear that various tractors with natural air intake (in contrast to forced air intake) do not show the same loss of power when working high above sea-level (1 400 m). The power losses in respect of power at sea-level have varied so far from no loss to 9 per cent.

The testing of safety frames and cabins for agricultural tractors

Fatal accidents with farm tractors virtually doubled from 1965 to 1974, increasing from 202 to 390. The cost of these accidents rose from R930 000 to R2 800 000.

In view of the high casualty rate as a result of tractors overturning, it was decided to test safety frames mounted on tractors.

Several test specifications for these tests already exist, in addition to specifications for the test equipment. The test specifications were drawn up and equipment was built that complies with the internationally recognised OECD and ISO specifications.

Pilot tests in order to become familiar with the equipment and test procedures have already been carried out. The official testing programme will start shortly.

Mechanisation planning

The technique developed for designing and/or evaluating mechanisation systems is becoming increasingly popular. The demand for courses and/or assistance in this connection has increased to such an extent that consulting agricultural engineers are now supplying this service as well. Guides on the subject have been revised and improved.

Haymakers and silage makers

During the past year priority was given to the testing of round balers and the evaluation of equipment for handling round bales. Round balers, which are relatively expensive in the nature of things, are an economic proposition when the areas under hay are big enough, i.e. around 150 ha and over.

Tractor and trailer brake tests

Many tractor accidents have been caused by

the fact that the trailer had inadequate brakes or even no brakes at all and the tractor-trailer unit jack-knifed when the tractor braked suddenly. A series of brake tests was therefore undertaken in co-operation with a manufacturer of trailers and the Transvaal Provincial Administration.

The trailer originally had only a parking brake. For testing purposes this was later converted to an overrun brake system. In the first test the trailer was empty and the braking distances were measured with (a) only the tractor's brakes in operation and (b) the tractor's and the trailer's brakes in action at the same time. The braking distances were as follows:

- (a) 9,5 m
- (b) 6,06 m

The speed of the combination was 25 km/h in both cases. In the second test the trailer had a load of 6½ tons. Only the test with both the tractor's and the trailer's brakes in operation was repeated. The braking distance in this case was 12,7 m and there appeared to be no risk of jack-knifing. The test trailer is being tested under practical conditions in the Bothaville district. When a report on the performance of the braking system under the above-mentioned conditions has been drawn up, the matter will receive further attention.

Mechanisation of the groundnut harvesting process

Because the price of groundnuts depends exclusively on the price obtained for export edible groundnuts on the overseas market, it is essential to produce a high percentage of groundnuts of a high quality.

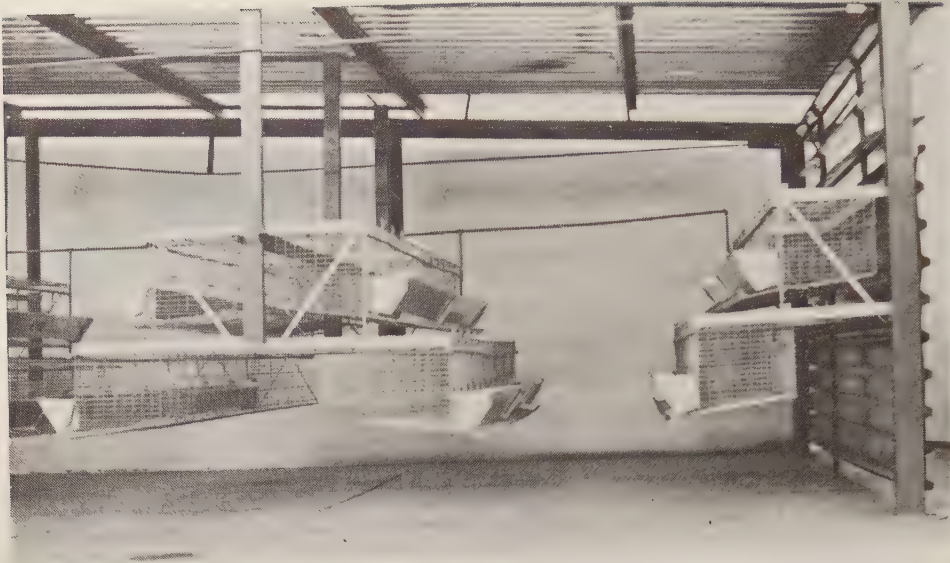
Mechanisation can impair the quality considerably if the correct methods are not followed. The quality is most likely to be affected during drying. In co-operation with interested firms, systems were developed that make provision for complete groundnut drying. The necessary equipment is commercially available at present.

A pamphlet describing the correct procedures for the entire harvesting process was prepared by the Division and is available as part of the Groundnut Series. This guide contains a design for a drying plant that the farmer can build himself.

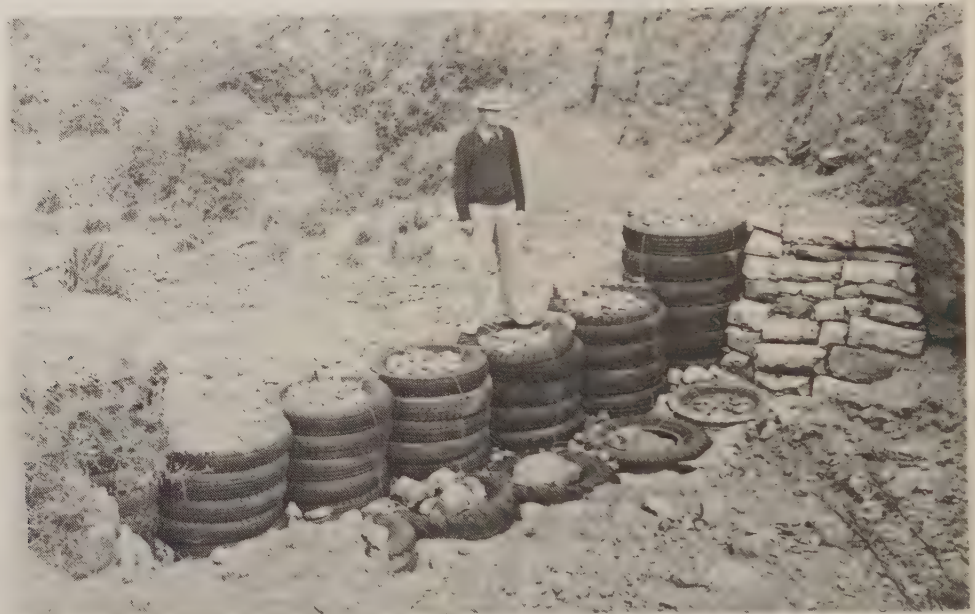
Mechanisation in tobacco production

In co-operation with the Tobacco Research Institute, the Division has for some years been studying the mechanical drying of tobacco and the mechanisation of other production processes.

Developments in tobacco mechanisation and drying were studied in the course of a visit to the Tobacco Control Board of Rhodesia. The visit was especially valuable in respect of energy saving during curing - by applying a backflow curing technique, fuel consumption can be reduced by 25 % in the case of batch curing.



Part of the interior of a developed laying house. Note that the laying batteries on the left are suspended from the roof beams, with no props on the floor



Various types of barriers are being tested in dongas. This structure was largely built from old motor tyres filled with stones

Grain drying

A guide on all aspects of artificial grain drying was published in pamphlet form as part of the Maize and Wheat Series.

During a symposium on energy in agriculture, solar energy for use in drying grain received a good deal of attention. However, more information on solar heaters is needed, since no such information is available for South African conditions.

Equipment for applying lime

Because lime penetrates the soil and spreads very slowly, a single tine subsoiler with a vine sulphur blower mounted on it was modified to see whether lime could be applied to a depth of about 0,7 m - evenly distributed over that depth. Field tests showed promising results in fairly loose soil.

It has not yet been possible to test the equipment in hard soil.

A complete study of the literature and a feasibility study will be undertaken to establish whether the project should be continued.

Cultural practices

Engineers from the Division make up part of the team of researchers from the Summer Grain Centre who are doing research on soil cultivation. Preliminary observations indicate that some of the unconventional cultural methods have considerable possibilities for soil and moisture conservation and energy saving. It should be remembered, however, that a departure from the conventional cultural methods often has a drastic effect on the production process.

Tests and a time study undertaken by the Division in co-operation with other interested bodies have shown that losses with cotton pickers are around 15 %, which compares well with hand picking. A producer should have over 120 ha of cotton to justify buying a cotton picker.

Locust sprayers

Refinements to the ultra-low volume locust spray have been completed and the manufacture of eight prototype truck-mounted locust sprayers was supervised. The eight prototypes, which are in the Karoo at present, will have to operate for a season or two before any possible faults will show up. A large number will then be manufactured on tender. No problems are foreseen. A guide on the correct use of the machine has been compiled.

Negotiations on the development of a knapsack sprayer for pest control are continuing.

Vineyard sprayers

There have been so many modifications to sprayers and so many new models have come onto the market that a third series of official tests had to be carried out on vineyard sprayers. The tests included field tests to determine the spraying efficiency of the machines and laboratory tests on the performance of the various parts. Ten machines, including three concentrate sprayers and two ultra-low volume sprayers, were entered for the test.

All the tests are expected to be completed shortly and the relevant test reports will be published early next year.

Orchard sprayers

A comparative review of technical specifications of commercially available orchard sprayers was published in "The Deciduous Fruit

Grower" (Vol. 27, Part II, November 1977). The editor of this periodical reports a very favourable response to the publication of the article, which is being prepared as a pamphlet at present. The testing of orchard sprayers was also started. A pilot trial was carried out to determine whether artificial targets made of paper were able to give a reliable indication of the spray precipitate on apple leaves. Chemical precipitate determinations were carried out in an attempt to find a correlation between the precipitate on the paper target and the precipitate on the leaves.

One pilot trial was carried out with three sprayers: two high-volume machines and one ultra-low volume machine. The results have still to be processed. The pilot trial indicates that the services of students will have to be employed on a large scale for the official tests on orchard sprayers.

Viticulture and Oenology

In co-operation with the Oenological and Viticultural Research Institute, a great deal of work is being done on various aspects of winery equipment, winery techniques and the mechanical harvesting of wine grapes. The following matters are receiving attention:

- The evaluation of winery equipment. Two wine presses were tested in co-operation with co-operative wineries, viz a Willmes press at Eersterivier winery and a Vaslin press at Vlothenburg. Reports on the results are being prepared.
- Thermovinification systems. Engineers of the Division again rendered assistance with the evaluation of several thermovinification systems and gave advice on related problems.
- The replacement of concrete wine tanks.

Many co-operatives and private wineries are still using concrete tanks for wine-making. As a result of age and other problems the walls crack and the plaster peels. The tanks become unhygienic



A state protection work under construction. The concrete is cast into the steel shuttering by means of a concrete pump and pipes

and can no longer be used for making good wine. In view of the high cost of alternative stainless steel tanks and the new buildings required, the question whether concrete tanks could not be economically repaired should be considered. An investigation is already in progress. Basically, it amounts to considering various alternatives, such as the repair of the concrete tanks with various types of cladding, the chopping out of the tanks and their replacement by stainless steel or fibreglass tanks and the abandonment of the concrete tanks and their buildings in favour of new buildings with new tanks.

Eventually a method will be found whereby winery managers can easily do the calculations themselves to find the most economic solution. This economic analysis should coincide with a long-term plan according to which the winery's long-term needs can be determined, so that the amount of expansion likely to take place can be assessed. This project should be completed before the end of the year.

Alcohol losses in husk tanks and quick fermenters

Big alcohol losses, chiefly as a result of evaporation, are experienced during the fermentation of skins in husk tanks and quick fermenters. An investigation into the practicability of tests to determine alcohol losses has been started. The OVRI will play a major part, since most of the work is of an oenological nature and entails a lot of chemical analysis, but the Division of Agricultural Engineering will be chiefly responsible for the economic study.

Work study on the transportation and packing of table grapes

The aim of this study is to develop less labour-intensive practices for the harvesting, transportation and packing of table grapes.

A pilot survey was carried out, chiefly in the Hex River Valley. It was found that practices vary a great deal. The biggest single factor responsible for this is the efficiency of management. The basic design and lay-out of the system had a relatively minor effect on labour utilisation. A report on this survey is being compiled at present.

Work study on the transportation of avocado pears from the producer to the port

The aim of the study is to find an alternative method that will reduce the transit period considerably and so prolong the shelf life of the avocados.

The transportation of avocados from the producer to the overseas markets takes about 24 to 28 days. The voyage takes 11 days. Since avocados

are a highly perishable product, any reduction in the transit period is important because it improves the shelf life and price of the product. The enterprise study is being carried out with a view to reducing the transit period, excluding the voyage.

Alternative methods are being investigated so that those that are impracticable can be eliminated. Possible alternative systems will then be studied in depth so that their economic viability can be determined, in view of the time-quality relation.

Handling, pre-cooling and cold storage of fruit

In co-operation with the Fruit and Fruit Technology Research Institute, considerable attention is being given to these important processes in the fruit industry. These projects include:

Investigation into the cooling and/or heating properties of fruit packed in various containers

The aim was to determine and improve the cooling properties, i.e. the cooling and heating rates, the temperature difference between the air and the fruit during storage and the quality of the fruit after storage for a certain period in containers of various designs, taking into account the various packing methods, stacking factors and cooling methods. Several tests were carried out on various types of fruit packed in a whole series of containers by various methods. Publications on the findings were drawn up.

Pre-cooling simulation of table grapes

The aim was to pre-cool table grapes, in order to evaluate quality, to several temperatures (7:4,5 and -0,5 °C) at the same pre-determined rate and then to store them at two temperatures, viz 1,5 °C and -0,5 °C. A second part of the project consisted of pre-cooling grapes, for the evaluation of quality, to 1,5 °C at various rates (120, 96, 72, 60 and 30 hours) and then storing them at -0,5 °C.

The method of simulation proved that, after temperatures had been monitored, there was a very good correspondence with the theory. Temperatures are therefore no longer monitored during this simulation.

Investigation into the pre-cooling properties of various stacking methods in commercial cold stores and the pre-cooling tunnels at the docks

Several methods of stacking packed fruit in commercial cold stores and pre-cooling tunnels were investigated in respect of their pre-cooling properties in an attempt to find a mathematical

connection between several properties. The aim of this work is to prolong the shelf life of the fruit through improved cooling practices and to boost the throughput of cold stores and tunnels by means of faster pre-cooling.

Several stacking methods, in the course of which mobile fan units were used to improve the air flow, were tested in a commercial cold store during the past season.

The information collected is still being processed and a report still has to be prepared, but it would appear that forced air cooling is the solution to the present problem. However, far more information on this method is needed before it can be applied efficiently on a commercial scale. Several modifications to matters such as packing and stacking methods are required.

ANIMAL HOUSING AND RELATED FACILITIES

With rising labour costs and more intensive housing of animals, there is a growing demand for expert guidance on the planning and design of animal houses and related equipment. In co-operation with the Animal and Dairy Science Research Institute and other interested bodies, attention is being given to several aspects of the matter. For instance, plans for dairy plants, pig farms, sheep housing, tick control operations and the handling of animal wastes were drawn up and made available to interested persons, and work on poultry housing was started. Some of the main achievements of this programme are mentioned below.

Equipment for the treatment of low-grade roughage with caustic soda

Research by animal scientists showed unequivocally that caustic soda significantly increases the nutritional value of lower-grade roughage. Suitable equipment for this treatment is a serious problem, however. The matter was studied and the shower process was developed. This process can be successfully applied by the ADSRI for long-term trials, but is impractical for use on the farm. A hammer mill and a continuous mixer were therefore successfully adapted for treating roughage with caustic soda. Satisfactory preliminary results have been obtained with a hammer mill and a mixer, and further development has been taken over by the industry. Both machines are commercially available at present. Further research is being conducted by the Division and the Industry.

Poultry housing

In view of the increasing demand for economic and practical plans for poultry houses, the Division of Agricultural Engineering started an investigation into poultry housing.

Two matters that had to be borne in mind at all times were ventilation and economics. Previous experience with the housing of other animals led to the development of a cheaper and simpler structure which should meet the ventilation requirements and which will undergo practical testing soon. A few characteristics of the structure are the flat roof with a 5° slope towards the north and the adjustable louvres, by means of which the direction of the air flow can largely be controlled. Plans of the structure are available.

Dairy housing

Pamphlets were published on calf housing methods and on the design and planning of a dairy unit to accommodate 100 cows in milk.

UTILISATION OF WATER IN AGRICULTURE

The Division's activities with regard to water utilisation centre around irrigation and drainage, with specific attention to the following:

- Research and development, chiefly in respect of equipment and techniques for sprinkler, drip and flood irrigation
- The testing of irrigation equipment
- The planning and design of irrigation systems
- Consultative services and training
- Professional auxiliary services

Research and development are geared to acquiring specialised engineering knowledge of all the most important aspects of irrigation, and applying this knowledge in the interests of the agricultural industry. The main object was to ensure the optimum utilisation of our limited water resources.

A few of the tasks that received attention are briefly described below.

Planning of irrigated soils

Working in close co-operation with all the other interested bodies, such as the Soil and Irrigation Research Institute, the Department of Agricultural Economics and Marketing and the Department of Water Affairs, the Division is giving increasing attention to the planning of irrigated soils and areas. The factors that contribute to the economic viability of the proposed schemes are coming in for closer study. These factors include development costs, the irrigation value of the land, the drainage requirements of the topsoil and subsoil, the choice of the most suitable irrigation systems, mechanical requirements and costs, and other aspects that play a part in making irrigation farming a profitable undertaking for both the State and the farmer.

A wide variety of investigations and plans received attention. They varied from investigations into proposed irrigation areas to the planning of single plots. Planning of this kind covered an extensive area, but the areas that fall under the



A protection work in the Karoo which is estimated to cost R140 000. It was designed by engineers of the Division of Agricultural Engineering and is being erected by the owner of the farm

Orange River Project came in for the most intensive attention.

Evaluation of flood irrigation systems in the Gamka Irrigation Scheme

In an attempt to find a solution to the serious brack problems that occur on this irrigation scheme, a critical evaluation of present systems was undertaken. It was established that the underlying cause is the total absence of irrigation scheduling or any kind of planning in respect of water application. This leads to regular over-irrigation, which is conducive to the development of brack conditions.

Although a new dam was built a few years ago, so that water is now available on demand, the old distribution system is still in use. Although the investigation revealed serious shortcomings, the basic problem of the scheme as a whole can be rectified only by providing gauging structures and concrete canals so that predetermined applications of water can be measured. Before farmers are able to measure stream size satisfactorily, a large-scale evaluation, accompanied by advice on rectifying any shortcomings, will not be justified.

Under present circumstances each problem is dealt with on its merits. By taking the necessary measurements, the bed irrigation is evaluated and

the required directions are then drawn up on the basis of the findings.

The application of gypsum through sprinkler irrigation systems

A device for applying gypsum in solution through existing sprinkler systems was built and tested. The problem is that the solubility of gypsum in irrigation water is only $2,6 \text{ kg/m}^3$. By feeding the gypsum in at a rate of $2,6 \text{ kg/m}^3$, stirring it well and passing it through a centrifugal pump, most of the gypsum can be dissolved. The insoluble gypsum is separated by means of a cyclone separator made from a petrol drum and fed back to the inlet side of the pump. The bridging problem experienced with dry gypsum is overcome by feeding the gypsum in paste form.

Friction losses caused by hydrants and foot valves

Because it was not known for certain exactly what part hydrants and foot valves play in the design of an irrigation system, friction loss determinations were carried out for 150 mm, 100 mm, 75 mm and 50 mm hydrants and for 150 mm, 100 mm and 75 mm foot valves at a flow

rate varying from 15 to 60 m³/h and 20 to 180 m³/h, respectively. The maximum friction losses varied from 0,25 m to 2,5 m of water for the hydrants (from big to small) and 0,8 m to 1,2 m water for the foot valves (also from big to small).

It was found that friction losses increase radically as the size of the valves and the hydrants decrease.

Drainage of irrigated lands

The Division of Agricultural Engineering is responsible for the approval of all irrigation schemes, on individual farms, for which the estimate exceeds R3 000. Farmers have become so conscious of the value of these measures that drainage systems are being constructed at an unusual rate. Indeed, almost 100 systems (of which the value per system exceeds R3 000) with a combined estimated value of almost R800 000 were approved by the engineering staff of Glen during the past year.

Evaluation of filter envelopes for drain pipes

The suitability of various types of filter material when used in conjunction with several types of drain pipes and the need for filters and envelopes are being studied.

The study included the determination of the entrance resistance of various drain pipes. It was found that the various types of pipe could be placed in the following order on the basis of resistance, working from high to low resistance: a pitch fibre pipe, earthenware pipe, plastic drain pipe with a fluted wall.

The effect of a filter envelope on inflow was studied. Clearly where an effective envelope is used the entrance resistance of the pipe is of secondary importance.

As in other trials, it was found in the course of drain pipe trials and permeability determinations that the flow through a pipe can decrease a great deal over a period. This appears to be caused by dissolved air in tap water, which is released and tends to result in blocking of the pores. An apparatus has been built by means of which the water supply to the experimental apparatus can be de-aerated by siphoning the water over a height of about 10 metres. The apparatus is in use at present.

A permeameter for the rapid determination of the permeability of soil samples has been completed and is functioning satisfactorily.

An attempt will be made to study the efficacy of filter layers in preventing clogging by means of laboratory tests and field observations.

SOIL CONSERVATION AND AGRICULTURAL RESOURCE PROTECTION

The Division of Agricultural Engineering

plays a leading part in the soil conservation campaign of the Department of Agricultural Technical Services, mainly with regard to the following:

- The protection of lands by means of run-off control planning, which is undertaken in co-operation with the Regional staff concerned
- Soil conservation research and development
- The construction of major soil conservation works in badly eroded and vulnerable areas
- Professional guidance on the engineering aspects of soil conservation to the Division of Soil Protection and the Regional staff entrusted with the design of soil conservation works

Protection of lands

The planning of catchments according to natural watersheds and low-lying water courses (depressions) has long been a generally accepted principle, especially in parts where field crops are grown intensively. This automatically means that long communal waterways, extending over various properties, often have to be built.

An example of the above is the Lusthof project in the Western Transvaal, one of the notable cases tackled recently. This is a very flat area of approximately 12 000 ha, belonging to about 26 owners. About 90 % of the area is under cultivation. Large volumes of flood water cause serious washaways and extensive areas are subject to waterlogging, which results in significant crop losses. Planning necessitated the building of several waterways, the longest of which is 20 km. All the owners co-operated in a praiseworthy manner and most of the construction work has already been completed.

Attention was also given to the problem of protecting pineapple lands on steep slopes in the Eastern Cape Region. The present position was determined by means of surveys carried out in co-operation with the Region and proposals were made for improved layouts to promote conservation farming.

PROFESSIONAL AND TECHNICAL SERVICES

The professional and technical services rendered by the staff of the Division to various Departments and other Government bodies cover virtually all the engineering aspects of agricultural mechanisation, instrumentation, buildings and structures, soil and water utilisation and courses of instruction offered at colleges of agriculture.

A summary of some of the most important tasks performed will give an indication of the nature and scope of this service, which is expanding every year.

Bulk storage of grain

In 1965 the Government launched a scheme for the erection of grain silos to encourage the bulk handling of grain.

The Division acts as technical adviser to the Grain Silo Committee and the Land Bank in terms of the loan scheme for the erection of bulk storage installations. Two engineers are working full-time on this project. Their work entails the appraisal of new plans and submissions in respect of serviceability, cost and method of execution and the certification of demands by contractors for loan funds.

Grain silos

The erection of grain silos is continuing steadily. Thanks to improved methods of soil cultivation and new grain varieties, yields are still increasing and in most of the grain-producing areas there is still a shortage of storage space notwithstanding the erection of new grain silos and the fact that existing silos are extended from time to time.

During the 1977/78 financial year no fewer than 13 projects were undertaken; the cost was about R20 000 000. Eight of these were new grain silos and the rest extensions to existing silos. These projects will provide a total storage capacity of over 800 000 m³; seven projects, which will provide a storage capacity of 400 000 m³, were ready to receive grain during the 1978 harvesting season.

It is estimated that the total storage capacity by 1985 will be around 22,5 million m³.

Glasshouses

Few new glasshouses were erected for Departmental establishments during the past year. The available funds were used for renovating older glasshouse structures and equipping them with mechanical cooling/heating equipment in order to modernise them.

Briefly, the following services were rendered in this connection:

Five glasshouses for research purposes, with 33 compartments, were modernised and one new glasshouse was erected.

The modernisation consists partly of making provision for more sensitive temperature control inside the glasshouses. Instead of one cooling unit per compartment, at least four smaller units, with more sophisticated control equipment, are being installed. This makes it possible to obtain more even cooling/heating.

Despite the fact that most establishments already have more than one glasshouse, there is a keen demand for additional glasshouses which it will not be possible to meet in the near future.

ADVISORY SERVICES AND EDUCATION

The Farming Development Subdivision is responsible for the co-ordination and promotion of

the Division's information services. All the subdivisions do research, however, and give advice on the basis of their research.

Publications

During 1973/74 the demand for publications on agricultural engineering rocketed from an average of 600 requests a month to about 12 000, since when it has remained more or less constant. This may be ascribed to the progressive policy on publications and publicity which the Division adopted at that time and has maintained to this day.

In addition to regular announcements during agricultural radio programmes, information on new titles is sent to the agricultural press and to interested persons whose names appear on an address list. Most of the queries about publications are prompted by announcements on agricultural radio programmes.

A new series of pamphlets was launched this year, viz "Comparative Reviews of Technical Specifications" (of implements and equipment). It is known as "CRTS". The combined specifications, as obtained from the dealers concerned, are shown in tabular form. This enables interested persons to ascertain from one publication what equipment is available on the market and how prices and specifications compare. Each CRTS that appears is accompanied by an informative article aimed at assisting interested readers to choose an implement or piece of equipment.

During the year a "CRTS" was drawn up for each of the following implements:

- Semi-mounted or trailed disc harrows
- Grain harvesters
- Wheat planters
- Fertiliser spreaders
- Cultivators
- Tined implements
- Mouldboard ploughs
- Row-crop sprayers
- Hay rakes
- Tine cultivator
- Tined implements
- Disc and drum mowers
- Pick-up balers
- Hay tedders
- Round balers
- Mechanised sprinkler irrigation
- Hammer mills
- Stock scales

Agricultural radio

The Division's weekly talk for the SABC on topical aspects of agricultural engineering generally evokes a great deal of interest. The various activities of the Division, such as short courses, demonstrations and lectures by the Director and senior members of staff, are given regular and full publicity.

Short courses, lectures and demonstrations

The demand is increasing to such an extent that these activities are taking up more and more of the time of officers of the Division. Numerous short courses were offered again, demonstrations given and lectures held, both for groups of farmers and for agricultural extension officers and persons whose jobs involve the supervision of an information service.

The tasks undertaken in this connection are outlined in the following paragraphs:

Jiffy courses

During July to November 1977 the Division of Agricultural Engineering presented the following series of programmed jiffy courses at the Division's premises at 141 Cresswell Road, Silverton.

- Pig housing
- Dairy farm facilities
- Hammer mills
- Greenhouses
- Soil tillage implements
- Tractor performance
- Grain drying and handling
- Irrigation scheduling
- Sheep housing
- Dips and animal scales
- Milking machines
- Feed processing
- Handling animal wastes
- Planters
- Mechanisation planning
- Groundnut mechanisation
- Sprinkler irrigation

With the exception of the course on mechanisation planning, the courses lasted for a day only. To make it possible to give the necessary attention to personal problems and questions by persons attending the courses, it was attempted to limit the groups to less than 20 persons. On average three courses were presented on each subject and the average attendance was around 12 per course.

Mechanisation planning

In addition to the programmed jiffy courses on this subject, numerous courses and lectures were presented in the field to agricultural extension officers, study groups, farmers' associations and dealers by staff of the Division. This topic is also included in the training programmes of the various dealers for their branch managers and other interested members of staff.

Drying and storage of grain

There is an increasing tendency to dry grain on the farm and store it temporarily. Farmers appear to be planning more successfully these days and making fewer mistakes, thanks to sustained extension on the subject. Several officers contributed to this service. In addition to articles

and pamphlets on the subject, which were very widely distributed, a single engineer in the Highveld Region designed 12 systems, gave 7 lectures to groups of farmers and broadcast 8 radio talks.

The pamphlet on drying was included in the maize and wheat series, and SAMSO sent it to about 20 000 maize farmers as a supplement to their magazine.

Feed processing

The provision of advisory services and plans in respect of feed processing, stock scales and related matters constitutes a major part of the duties of the engineers and the section. Indeed, the senior engineer of the section devoted most of his time to these matters.

Irrigation and drainage

The variety of information services rendered by the irrigation engineering staff included the following:

- A two-week course for 30 professional officers of the Department of Agricultural Technical Services, held in co-operation with the Soil and Irrigation Research Institute.
- Seven farmers' days, the combined attendance being 240 farmers. Emphasis was placed on the potential and the limitations of the mechanised sprinkler irrigation systems that are rapidly increasing in popularity, and on planning and design standards.
- A guide for field officers, compiled by the staff at Glen. Owing to the increasing interest in the drainage of irrigated soils, the engineering staff stationed at Glen, and concerned chiefly with providing information on planning, devoted a great deal of attention to related extension work.

General

Other areas where there is an increasing demand for specialist information services and where the Division's staff are playing a leading role are the following:

- Dairy machinery and equipment
- Soil cultivation, particularly minimum cultivation methods and related implements
- The handling of animal wastes, chiefly at intensive livestock housing units. Several publications have appeared.

Training of diploma students

The training of diploma students in agricultural engineering subjects at colleges of agriculture is less important in the livestock areas than in the crop farming areas, but agricultural engineering is one of the main subjects on the syllabus at all the colleges. During the year the study material was critically discussed at a meeting of the officers in question and changes were made where necessary. Intensive guidance on teaching techniques, especially the use of visual aids, is also

being given to officers engaged in teaching. This matter will receive increasing attention in future.

CHEMICAL SERVICES

During the past year the Analytical Chemistry Subsection of the Highveld Region analysed a total of 8 030 soil samples and 5 289 plant and feed samples. The corresponding figures for the previous year were 7 915 and 4 173.

The analysis of soil samples from the preferential development areas of the Region constituted the Subsection's biggest task. There are indications that increasing use is being made of the analytical service for purposes of giving advice on fertilising.

The accompanying table shows the scale of operations of the analytical service during the past two years:

The number of plant samples submitted by farmers was about 40 % lower than during the previous year and the number of water samples analysed on behalf of farmers showed an increase of 60 % as against the previous year.

Judging from the pH, liming is required on about half the soils represented by samples. In general the soils were fairly well supplied with plant nutrients except for phosphate, which was low in about 48 % of the soils. In under 10 % potassium was low and 25 % of the soils had a low calcium status, as was partially confirmed by the low pH values. Since only 5 % of the soils were low in magnesium, little dolomitic lime is required.

Soil analyses	Number of samples		Number of determinations	
	1976/77	1977/78	1976/77	1977/78
Preferential development areas	5 019	3 600	92 731	61 590
Fertilising advice	2 157	2 716	23 727	29 876
Research sections	739	1 714	8 039	12 679
Plant and feed analyses				
Plant analyses for research purposes	4 016	5 265	8 763	21 006
Plant and feed analyses for farmers	12	18	33	56
Feed analyses for research purposes	145	771	6	24

It is apparent from the number of analyses carried out that this service is becoming increasingly popular among farmers and that the service has been extended to other sections within the region. The number of soil samples analysed on behalf of farmers in the Eastern Cape Region this year, namely 1 022, shows a slight increase on the 974 samples analysed the previous year. The total number of soil, plant and water samples decreased, however, from 2 803 last year to 2 433 during 1977/78.

ADMINISTRATIVE MATTERS

THE ESTABLISHMENT

POSTS

The following is an indication of the posts in the Department (in the respective Divisions into which the posts are divided in the Public Service) as at 30 June 1978, as well as of the number of vacancies in each Division, compared with the corresponding period for the previous year.

Division	Authorised posts	1977-06-30		Authorised posts	1978-06-30	
		Vacant posts Number	%		Vacant posts Number	%
Administrative	172	16	9,3	190	12	6,3
Clerical	511	40	7,8	514	49	9,5
Professional	1 459	246	16,9	1 470	232	15,8
Technical	1 660	237	14,3	1 683	268	15,9
General A	81	6	7,4	81	10	12,3
General B	2 217	291	13,1	2 235	329	14,7
Non-classified	187	60	32,1	190	22	11,6
Posts additional to the authorised establishment	88	36	40,9	86	44	51,2
Total	6 375	932	14,6	6 449	966	15,0

Increase/decrease in the number of authorised posts in the various divisions over the past five years:

Division	1974-06-30	1975-06-30	1976-06-30	1977-06-30	1978-06-30	Total % increase or decrease
Administrative	155	164	163	172	190	+ 22,6
Clerical	478	481	494	511	514	+ 7,5
Professional	1 583	1 494	1 501	1 459	1 470	- 7,1
Technical	1 566	1 586	1 609	1 660	1 683	+ 7,5
General A	86	85	84	81	81	- 5,8
General B	2 324	2 216	2 220	2 217	2 235	- 3,8
Non-classified	174	171	150	187	190	+ 9,2
Total	6 366	6 197	6 221	6 287	6 363	- ,05

Note: Non-classified posts do not include posts additional to the establishment

IMPORTANT ORGANISA-
TIONAL AND
ESTABLISHMENT
CHANGES

1. The Data Processing Subdivision of the Department was designated to act as a service bureau for the budgeting by objectives of Government departments and its establishment was consequently suitably strengthened from 1 November 1977.
2. Livestock improvement schemes in South-West Africa were transferred from the Animal and Dairy Science Research Institute to the South-West Africa Region on 1 December 1977.
3. Analytical services in the Transvaal Region were transferred to the Soil and Irrigation Research Institute on 1 January 1978.
4. As a result of the independence of Bophuthatswana the State Veterinary Office at Mafeking was closed on 1 February 1978 and the White service area incorporated into neighbouring State veterinary areas.
5. The foundation seed potato unit at Sabie was

transferred from the Division of Plant and Seed Control to the Transvaal Region on 1 May 1978.

6. Poultry research was centralised in the main complex of the Animal and Dairy Science Research Institute at Irene from 1 May 1978.
7. The Research Subdivision of the Natal Region was reorganised from 1 June 1978 in order to adapt to changed service requirements.
8. The establishment of the Finance Division of the Department was strengthened at the control and management level to make provision for the application of the Financial Management System. The application of this system also resulted in administrative/clerical changes to the establishment in the following Departmental institutions:
Winter Rainfall Region
Transvaal Region
Plant Protection Research Institute
Citrus and Subtropical Fruit Research Institute
Fruit and Fruit Technology Research Institute
Oenological and Viticultural Research Institute
Division of Veterinary Services

STAFF GAINS AND LOSSES

Division	1976-07-01-1977-06-30			1977-07-01-1978-06-30		
	**Gains	*Losses	%	**Gains	*Losses	%
Administrative	16	16	+ 11,1	8	12	- 50,0
Clerical	172	128	+ 25,6	127	130	- 2,4
Professional	142	152	- 7,0	139	115	+ 17,3
Technical	228	193	+ 15,3	193	183	+ 5,2
General A	25	18	+ 28,0	16	16	-
General B	677	610	+ 9,9	600	612	- 2,0
Non-classified	59	72	- 22,0	62	39	+ 37,1
Total	1 321	1 189	+ 10,0	1 145	1 107	+ 3,3

** By "Gains" is meant all persons gained by every Division, i.e. appointments from outside, promotions and translations from one Division to another and transfers from other Departments.
* By "Losses" is meant all persons lost by various Divisions (individually or jointly), including translations and promotions to other Divisions and cases where persons left the service for good, such as resignations, deaths, retirements, abscondences and dismissals.

STAFF CHANGES (SENIOR STAFF)

RETIREMENTS

The following senior officers retired from the service of the Department after a long career, on reaching the age limit:

Name	Rank	Institution to which attached	Years of service	Date of leaving service
Dr S.W. Pienaar	Director	Free State Region	37 years	1977-12-31
Mr J.F. Peens	Director	Tobacco Research Institute	34 years	1978-05-31
Dr M.S. le Roux	Deputy Director	Oenological and Viticultural Research Institute	38 years	1977-08-31
Mr J.F. la G. Matthee	Assistant Chief Engineer	Division of Agricul- tural Engineering	39 years	1978-04-30
Mr C.J. Wessels	Under-Secretary	Head Office: Statutory Control	39 years	1977-11-30

DEATHS

The Department learned with regret of the death of Dr T.A.T. Louw, Assistant Director of the Division of Veterinary Services, on 17 June 1978.

PROMOTIONS

Name	Rank	Institution	Date of promotion
Dr J.C. Oosthuizen	Director (Personal)	Animal and Dairy Science Research Institute	1977-12-01
Mr H.S. Niehaus	Director	Eastern Cape Region	1978-01-01
Mr R.J. van Niekerk	Director	Division of Agricultural Information	1978-04-01
Dr J. Deist	Deputy Director	Oenological and Viticultural Research Institute	1977-09-01
Dr J.W. Snyman	Deputy Director	Crops and Pastures Institute	1978-01-01
Mr J.L. Vosloo	Deputy Director	Division of Soil Protection	1978-01-01
Mr G.W. Oosthuyzen	Deputy Director	Free State Region	1978-06-01
Mr J.F. Eloff	Assistant Director	Soil and Irrigation Research Institute	1977-08-01
Mr J. de Kock	Assistant Director	Crops and Pastures Institute	1977-08-01
Mr K.W. Pakendorf	Assistant Director	Crops and Pastures Institute	1977-08-01
Dr H.H.P.A. Schneider	Assistant Director	Division of Veterinary Services	1977-12-01
Dr P.C. van Rooyen	Assistant Director	Oenological and Viticultural Research Institute	1978-01-01
Mr C. Kok	Assistant Director	Oenological and Viticultural Research Institute	1978-01-01
Mr S.W.B.J. van Rensburg	Assistant Director (Administrative)	Highveld Region	1978-04-01
Mr L.L. Lötter	Assistant Director	Division of Agricultural Information	1978-05-01
Mr M.L. Heyns	Assistant Director	Division of Soil Protection	1978-06-01
Mr J.A. Stofberg	Assistant Director	Soil and Irrigation Research Institute	1978-06-01
Mr F.J.C. Hugo	Assistant Chief Engineer	Division of Agricultural Engineering	1978-05-01
Mr A.M. Meyer	Principal Engineer	Division of Agricultural Engineering	1977-12-01
Mr P.J. Loubser	Under-Secretary	Head Office, Technical and Legal Affairs	1977-12-01

TRAINING AND STAFF DEVELOPMENT

number of bursaries awarded since 1976 and the monetary value:

BURSARY SCHEME

The Department administers a bursary scheme for under-graduate study at local universities from funds donated by the various Control Boards. The following table shows the

	Number of bursaries		Studies completed	Total monetary value of new grants R
	New grants	Total		
Grants up to 1976	38	202	34	98 000
Grants up to 1977	46	214	31	137 500
Grants up to 1978	33	216	31	86 500

In 1978 one bursary for post-graduate study in agricultural science at a local university was awarded from Agricultural control board funds.

IN-SERVICE TRAINING

In order to promote efficiency and foster skills and motivations, staff serving on the establishment of the Department underwent the following training:

	Number of officers involved
<i>Administrative courses:</i>	
Induction	156
Supervision	196
Management courses for managerial officers	72
<i>Functional courses:</i>	
Budgeting by objectives	55
O en M provisioning technique	23
Irrigation course for technicians	33
Congress for directors and chief professional officers (extension)	35
Overseas study (advanced scientific training)	9
Overseas trips. See Annexure VII	

FORMAL TRAINING

Officers of the Department are afforded ample opportunity to improve their academic qualifications at Government expense, for purposes of appointment, promotion and also self development, as is evident from the following:

<i>Diploma training:</i> Technicians and meat inspectors	
Undergoing training	199
Training completed	54
<i>Formal in-service training:</i> Meat examiners	
Undergoing training	8
Training completed	5

<i>Post-graduate study</i> (Local universities)		
Exempted for study (1978)	B.Sc.(Hons.)	6
	B.Agric.(Hons.)	
	(Inst./Agrar)	8
	B.Sc.(Agric.)	
Studies completed (1977)	(Hons.)	22
	B.Agric.(Hons.)	
	(Inst./Agrar.)	9
	B.Sc.(Agric.)	
<i>Diploma training (Optional):</i>		
Public Adminstration, State Accounts and Finance, Cost Accounting		20

COMPUTER SERVICES

Computer facilities

The Computer Centre has an interactive processor Burroughs B7700 computer with 75 terminals linked throughout the country at its disposal. A computer service of one kind or another was rendered to 14 Government departments.

Work load

The computer was used five days a week, 24 hours a day as well as 16 hours during week-ends. Expressed in monetary terms, the following use was made of the facilities of the Computer Centre:

	R
Computer services	2 651 185
Punching services	113 120
Programming services	No charge
Total	2 764 305

The actual cost of running the Computer Centre for the year was R2 110 342.

VII. Annexures

(1) ORGANISATION AND FUNCTION OF THE DEPARTMENT

(a) HEAD OFFICE

(Agricultural Building, Beatrix Street/Private Bag X116, Pretoria)

Management

Dr W.A. Verbeek: Secretary (retires 78-12-31) (Dr D.W. Immelman w.e.f. 1979-01-01)

Directorate of Agricultural Technical Services

Dr D.W. Immelman: Chief Director (Chairman)
Dr J.C. Strydom: Chief Director (Horticulture)
Prof. S.A. Hulme: Chief Director (Crops and Pastures)
Dr D.J. Agenbach: Chief Director (Agricultural Resource and Farming Development)
Dr B.C. Jansen: Chief Director (Animal Production)

Administrative Branch

Mr B.W. Viljoen: Senior Deputy Secretary

Personnel and Training

Mr J.C. Visser: Deputy Secretary
Mr P.M.A. Spreeth: Under Secretary (Personnel Administration)

Auxiliary Services

Mr L.J. Botha: Deputy Secretary
Mr G.J. Smit: Under Secretary (Data Processing)
Mr M.D. Meyer: Under Secretary (Sundry Services)
Mr G.P. Kleinhans: Chief Work Study Officer

Technical and Legal Affairs

Mr B.J. Dreyer: Deputy Secretary
Mr A.C. Bosch: Under Secretary (Technical Administration)
Mr C.S. de Villiers: Under Secretary (Statutory Control) (w.e.f. 1977-12-01)
Mr P.J. Loubser: Under Secretary (Legislation and Parliamentary)
Mr G.M. Botha: Under Secretary (Foreign Affairs)

Finance

Mr P.F. Nortjé: Chief Accountant
Mr J.J. Lombard: Assistant Chief Accountant

Objective Budgeting

Mr H.F. van Zyl: Under Secretary

Departmental Inspectorate

Mr H.J. Kriek: Inspector

(b) SUBDIRECTORATE

Dr A.D. Nieuwoudt: Director (Co-ordination of Irrigation)
Dr J.J. du Toit: Deputy Director (Co-ordination of Agricultural Research)
Mr R.W. Nott: Deputy Director (Co-ordination of Agricultural Resource Development)
Mr A.B. Bridgens: Deputy Director (Secretary-General, SARCCUS)
Dr J.P. Jooste: Deputy Director (Biometry Services)
Dr N.J. Robbertse: Assistant Director (Training)

Crops and Pastures Institute

Prof. A.J. Pienaar: Director
Mr T.E. Skinner: Deputy Director
Dr J.W. Snyman: Assistant Director

The Institute does not itself engage in research but gives guidance to research workers engaged in research in the different regions on summer grain, winter grain, other agricultural crops, pastures and pasture crops, and co-ordinates all research in this connection. The co-ordination of weed and poisonous plant research at the national level, as well as supplying technical information in connection with weedicides, is also a function of the Institute.

(c) FOREIGN REPRESENTATIVES

Paris (South African Embassy, 59 Quai D'Orsay, 75007 Paris, France)

Dr J.G. Boyazoglu: First Counsellor (Agricultural Technical)

Mr J.A. Thomas: Counsellor (Agricultural Technical)

Mr J.U. Rietman: Attaché (Agricultural Technical)
London (South African Embassy, Trafalgar Square, London WC2N 5DP, England)

Dr A.C. Myburgh: Counsellor (Agricultural Technical)

Washington (South African Embassy, 3051 Massachusetts Avenue NW, Washington DC 20008, USA)

Dr A.D. Venter: Counsellor (Agricultural Scientific)

Dr J.E. Nel: Attaché (Agricultural Scientific)
Canberra (South African Embassy, Rhodes Place,
Yarralumla, Canberra ACT 2600, Australia)
Mr J.H. l'Ons: Counsellor (Agricultural Technical)
(1978-01-01)

(d) SPECIALISED RESEARCH INSTITUTES

Soil and Irrigation Research Institute Belvedere Street, Private Bag X79, Pretoria

Dr M.C. du Plessis: Director
Dr P.F. Fuls: Deputy Director
Dr C.N. MacVicar: Deputy Director
Dr C.E.G. Schutte: Assistant Director (Chemical
Analyses)
Mr J.F. Eloff: Assistant Director (Soil Survey)
(1977-08-01)
Mr J.A. Stofberg: Assistant Director (Irrigation
Planning)
Dr A.L. du Pisani: Assistant Director (Agricultural
Meteorology)
Dr G.C. Green: Assistant Director (Irrigation
Research)

The Institute is responsible for the classification of the soil and climatic resources of the Republic and also basic research with regard to the physical and chemical characteristics of soils on a national level. Soil surveys for irrigation projects and investigations into physical soil characteristics are also undertaken - particularly where brack and waterlogging conditions occur. In addition, the Institute undertakes chemical soil, water and plant material analyses, not only for this Department but for other State Departments, provincial administrations and other bodies. The Institute is also responsible for the inspection and analysis of fertilisers, stock feeds, stock remedies and agricultural remedies in terms of Act 36 of 1947. It is also responsible for basic irrigation research, and the agricultural evaluation and planning of irrigation areas. All agricultural meteorological research and data collection also falls under this Institute.

Plant Protection Research Institute Agricultural Building, Beatrix Street, Private Bag X134, Pretoria

Dr I.H. Wiese: Director
Dr D.P. Annecke: Deputy Director
Mr I.G. Venter: Assistant Director (Locust
Control)
Mr H.P. van Heerden: Assistant Director
(Phytosanitary Services)
Dr B.W. Strydom: Assistant Director (Plant
Pathology/Microbiology)
Mr D.J. Engelbrecht: Assistant Director (Virus
Research)

The Institute is broadly responsible for advanced research and research at the national level on plant pathology, insect and animal pests and

their control. This includes microbiology, taxonomy of fungi, identification of virus diseases, the freeing of propagating material from viruses, honey-bees, insects in stored grain, forest and timber insects, taxonomy of insects and nematodes, economic zoology, toxicology of insecticides and the biological control of insect pests and weeds. The Institute is also responsible for the examination and control of imported plant material and the control of migratory locusts. The Institute uses the research stations and experimental farms at Rietondale (Pretoria), Buffelspoort (Marikana), Fleurbaix and the quarantine station (Stellenbosch), as well as the research units for the control of prickly pear and jointed cactus at Uitenhage and forest pests at Rosebank (Cape Town).

Botanical Research Institute Private Bag X101, Pretoria

Dr B. de Winter: Director
Dr D.J.B. Killick: Deputy Director
Dr D. Edwards: Assistant Director

The Institute undertakes basic research on the flora and vegetation of South Africa with emphasis on taxonomy, morphology, ecology and economic botany. The Institute also controls the Botanical Garden at Brummeria (Pretoria) and herbaria in Durban, Grahamstown, Kimberley, Pretoria, Stellenbosch and Windhoek.

Citrus and Subtropical Fruit Research Institute Private Bag X11208, Nelspruit

Dr J.H. Grobler: Director
Mr A. van Oostrum: Deputy Director
Dr D.L. Milne: Assistant Director

The Institute is responsible for country-wide research on all aspects of the citrus and subtropical fruit industry, as well as nuts, tea, coffee and herbs. The Institute also undertakes research at the research stations and experimental farms Addo (Eastern Cape), Burgershall, Citrusdal, East London, Friedenheim, Levubu (Louis Trichardt), Messina and Rustenburg.

Horticultural Research Institute Private Bag X293, Pretoria

Mr E. Strydom: Director
Dr J.T. Meynhardt: Deputy Director
Mr O.J. Olivier: Assistant Director

The Institute is responsible for all applied and fundamental research and extension on vegetables, cut-flowers, ornamental plants and shrubs throughout South Africa and on deciduous fruit and table grapes in the summer rainfall areas. The Institute controls research stations for vegetables, flowers, decorative plants, table grapes and deciduous

fruit research at Roodeplaat in the Transvaal Middleveld and for cherry and deciduous fruit at Emperani, near Ficksburg. In addition the Institute undertakes research on vegetables in the winter rainfall area at Elsenburg, Outeniqua and Lutzville, as well as at Glen in the Orange Free State, at Nelspruit in the Transvaal Lowveld, at Cedara in Natal and at Addo in the Eastern Cape. Research on indigenous flowers, mainly proteas, is undertaken at Elsenburg and at the Tygerhoek Research Station near Riviersonderend.

Tobacco Research Institute

Kroondal, Private Bag, Rustenburg

Dr D.J. Rossouw: Director (w.e.f. 1978-09-01)

Dr D.J. Rossouw: Deputy Director

Dr M.P. Lamprecht: Assistant Director

The Institute is responsible for research, including technological aspects, in the interests of the tobacco industry in all parts of the country. The Institute also undertakes research work on research stations and experimental plots at Groblersdal, Hartebeespoort (Brits), Nelspruit, Oudtshoorn, Potgietersrus and Stellenbosch.

Veterinary Research Institute

Post Office Onderstepoort, Pretoria

Dr K.E. Weis: Director

Dr R.D. Bigalke: Deputy Director

Dr T.W. Naudé: Deputy Director

Dr C.J. Howell: Assistant Director (Parasitology and Reproduction)

Dr D.W. Verwoerd: Assistant Director (Virus Diseases)

Dr C.M. Cameron: Assistant Director (Bacterial and Protozoic Diseases)

Dr J.G. Pienaar: Assistant Director (Pathology)

Dr B.J. Erasmus: Assistant Director (Professional/Technical Auxiliary Services)

Dr L.A.P. Anderson: Assistant Director (Biochemistry)

Mr F. Visser (w.e.f. 1978-08-01): Special Grade Control Technician (Vaccine Production)

Mr K.P. Naudé: Assistant Director (Administrative)

The Institute is concerned with research on diseases of stock and game (infectious and others, including diseases caused by malnutrition), diagnostics, the preparation of vaccines and diagnostic aids, and the biological evaluation of dips and remedies submitted for registration.

Animal and Dairy Science Research Institute

Private Bag X2, Irene

Dr J.H. Hofmeyr: Director

Dr J.C. Oosthuizen: Director (Personal)

Dr P.E. Lombard: Deputy Director

Mr J.S.A. Landrey: Assistant Director (Stock Improvement) (retired on 1978-10-31)

Dr J.G. Cloete: Assistant Director (Animal Physiology and Nutrition)

Mr W.C.J. Viljoen: Assistant Director (Poultry Science)

Dr J.H. Labuschagne: Assistant Director (Dairy Research)

Dr H.A. Lück: Assistant Director

The Institute, at various centres throughout the country, undertakes at the national level performance and progeny testing as well as fundamental research on the breeding, feeding and physiology of farm animals. The Institute is also responsible for dairy and poultry research on a country-wide basis as well as for the training of dairy technologists at Glen. The Institute has at its disposal a main research station at Irene, undertakes poultry research at Potchefstroom, Elsenburg, the University Experimental Farm at Pretoria and Cedara, and controls random testing of poultry at Irene and Glen as well as pig-testing stations at Irene, Cedara and Elsenburg, and bull-testing stations at Queenstown and Omatjenne (South West Africa).

Fruit and Fruit Technology Research Institute

Private Bag X5013, Stellenbosch

Dr P.G. Marais: Director

Dr A.J. Heyns: Director (Personal)

Dr W.J. Pienaar: Assistant Director (Chemistry, Fruit Processing, Plant Biochemistry, Cold Storage and Radio Isotopes)

The Institute is responsible for research on deciduous fruit, table grapes and certain aspects of proteas in the winter rainfall area, as well as for research at national level in connection with certain technological aspects of fruits and other agricultural products. The Institute further renders a radiation and radio-isotope service in connection with agricultural problems in the winter rainfall complex. The Institute controls the research stations and experimental farms at Groot Drakenstein (Bien Donné), Citrusdal, De Doorns, Elgin, Langkloof, Paarl and Robertson.

Oenological and Viticultural Research Institute

Private Bag, Stellenbosch

Dr J. de V. Burger: Director

Dr J. Deist: Deputy Director (1977-08-01)

Dr P.C. van Rooyen: Assistant Director

Mr C. Kok: Assistant Director

The Institute is responsible for all research in the sphere of oenology and viticulture for the winter rainfall area, and all viticultural research in the Lower Orange River area. For this purpose the Institute has at its disposal research stations at Stellenbosch (Nietvoorbij) and Robertson, as well as experimental vineyards at Upington and Lutzville. The

Institute controls the historic wine farm Groot Constantia

(e) DIVISIONS

Division of Agricultural Engineering

Private Bag X515, Silverton

Mr J.J. Bruwer: Director

Mr C.T. Crosby: Chief Engineer

Dr B. van D. Boshoff: Chief Engineer

Mr P.J. Pienaar: Assistant Chief Engineer (Soil Conservation Works - Aliwal North)

Mr F.J.C. Hugo: Assistant Chief Engineer (Mechanization: Plant Production)

Mr J. Veenstra: Assistant Chief Engineer (Mechanization: Animal Production)

Mr C.J. van Schalkwyk: Assistant Chief Engineer (Farm Development)

Mr I. Scheepers: Assistant Chief Engineer (Winter Rainfall Complex - Stellenbosch)

Mr J.H. Eckhard: Assistant Chief Engineer (Irrigation Engineering)

Mr H.W.P.W. Struck: Assistant Chief Engineer (Soil Conservation Engineering)

Mr P.J. Pienaar: Assistant Chief Engineer (Soil Conservation Works)

The Division has a specialised task and devotes itself to all engineering problems in the agricultural industry such as mechanisation, (farm power and machinery), soil conservation, water utilisation, farm structures, handling of material, storage of grain, cold storage and processing of fruit, vegetables and other assigned products, as well as all other engineering services with which the Department is concerned, such as the preparation and development of plots on irrigation schemes. In addition to providing construction, utility, expert extension, regulatory and testing services in the above connection, the Division also undertakes related research.

Division of Agricultural Information

Agricultural Building, Private Bag X144, Beatrix Street, Pretoria

Mr R.J. van Niekerk: Director

Mr L.L. Lötter: Assistant Director (Information)

Mr Q. Momberg: Assistant Director (Publications)

The function of the Division is the distribution of agricultural information by the mass media. For this purpose use is made of scientific and popular agricultural publications, radio programmes, audiovisual aids and press releases. The Division is also responsible for the maintenance of an agricultural information bureau.

Division of Plant and Seed Control

Agricultural Building, Beatrix Street, Pretoria

Mr J.F. van Wyk: Director

Mr D.C. Lourens: Deputy Director

Mr A.J. Cronjé: Assistant Director (Quality

Control)

Mr L.J. Grobler: Assistant Director (Inspection and Control Services)

The functions of this Division include the protection of propagation material and the assurance of its quality. The Division administers the Seeds Act (Act 28 of 1961), the Plant Breeders' Rights Act (Act 22 of 1964) and the Agricultural Pests Act (Act 3 of 1973).

Division of Soil Protection

Agricultural Building, Beatrix Street, Private Bag X120, Pretoria

Dr J. Serfontein: Director

Mr J.L. Vosloo: Deputy Director

Mr M.L. Heyns: Assistant Director (Land and Weed Control)

Mr T. Brenkman: Assistant Director (Administrative)

The Division is responsible for the administration of the Soil Conservation Act (Act 76 of 1969), the Weeds Act (Act 42 of 1937), and the Subdivision of Agricultural Land Act (Act 70 of 1970). The Division also administers the following assistance schemes in terms of the Soil Conservation Act: the Financial Assistance Scheme, Flood Assistance Scheme, Stock Reduction Scheme, Veld Reclamation Scheme and Grass Ley Scheme.

Division of Veterinary Services

Transvaal Agricultural Union Building, 28 Struben Street, Private Bag X138, Pretoria

Dr J.P. van der Merwe: Director

Dr J.D. Coetzee: Deputy Director

Dr J.M. Erasmus: Deputy Director

Dr A. van Heerdën: Assistant Director (Major Disease Eradication Schemes and Notifiable Diseases)

Dr G.C. Dent: Assistant Director (Import and Export Control, Bantu Veterinary Services and Border Control and Nagana Control)

Dr P.P. Bosman: Assistant Director (Regional Diagnostic Services, Training, Extension, Animal Health, Non-notifiable Diseases, A.I. Services, Liaison and Publications)

Dr C.W.A. Belonje: Assistant Director (Eastern Cape and Karoo Region - East London)

Dr A.E. Gillepsie: Assistant Director: (Meat Hygiene and Related Matters)

Dr W.M.H. Löwe: Assistant Director (Highveld Region - Potchefstroom)

Dr E.O. le Riche: Assistant Director (Winter Rainfall Region - Stellenbosch)

Dr R.R. van der Veen: Assistant Director (Free State Region - Bloemfontein)

Dr F.B.W. du Casse: Assistant Director (Transvaal Region - Pretoria)

Dr L.R. Hurter: Assistant Director (Northern and Eastern Transvaal Region - Pietersburg)

Dr W.H.B. Bühr: Assistant Director (Natal Region - Pietermaritzburg)

Dr C.J. Coetzee: Assistant Director (Stock Disease Control)
 Dr H.H.P.A. Schneider: Assistant Director (SWA Region, South - Windhoek)
 Dr C. van N. Jonker: Assistant Director (SWA Region, North - Windhoek)
 Mr F. Huisman: Assistant Director (Administrative)

The Assistant Directors of the Regions are under the direct control of the Director. The Division has a specific task in regard to animal health as laid down in the Animal Diseases and Parasites Act, 1956 (Act 13 of 1956) and regulations promulgated in terms thereof. The Division guards against the introduction of diseases by erecting, patrolling and maintaining game- and cattle-proof fences on the borders of the Republic and South West Africa and by controlling animal imports. For domestic protection regular inspections of all stock are carried out. The promotion of animal health schemes to eradicate certain diseases and animal health in general enjoy high priority. The Division also has four Regional Veterinary Laboratories throughout the Republic and South West Africa for local investigation of stock losses, problems relating to animal health and suboptimal production and reproduction. In terms of the Animal Slaughter, Meat and Animal Products Hygiene Act, 1967 (Act 87 of 1967), the Division is responsible for the promotion and maintenance of hygiene in cattle slaughterings and handling of meat and animal products, for preventing the transmission of diseases to human beings and animals by disease-infected animals, meat or animal products, for preventing cruelty to animals slaughtered at abattoirs and for controlling the importation of meat.

(f) AGRO-ECOLOGICAL REGIONS

The eight Regional Organisations of the Republic, as well as of South West Africa, are responsible within their respective geographical areas, for the planning, development, promotion and application of farming systems based on optimal land utilisation.

Each of these organisations provides an extension service in which the soil conservation effort is integrated and which also covers every aspect of farming. The research services are directed to the collation and releasing of scientific knowledge for the optimal utilisation of the natural agricultural resources. The research personnel are also responsible for specialist extension work and for supplying training services to the agricultural colleges.

Eastern Cape Region

PO Box 233, Queenstown

Mr H.S. Niehaus: Director

Mr J.H. Stapelberg: Deputy Director

Mr J.L. van der Walt: Assistant Director (Research)

Mr B.J. Krige: Assistant Director (Extension) (1977-08-01)

Research stations: Dohne (central research station) at Stutterheim, and Bathurst (Port Alfred). A number of experiments are also conducted at East London.

Free State Region

Agricultural College, Glen

Dr W.J. Hugo: Director

Mr G.W. Oosthuysen: Deputy Director

Dr P.J. Niemann: Assistant Director (Research)

Mr D.J. Hattingh: Assistant Director (Extension)

Mr P.F. du Toit: Assistant Director (Research)

Mr G.W. Long: Assistant Director (Administrative)

Glen College of Agriculture: Research stations and experimental farms: Glen (central research station), Armoedsvlakte (Vryburg), Koopmansfontein (Barkly West), Rietrivier (Herbert), Sandvet, Sydenham, Upington Complex and Vaalharts (Jan Kempdorp).

Highveld Region

Private Bag X804, Potchefstroom

Dr J.D. Slabber: Director

Dr J.E. van Niekerk: Deputy Director

Dr W.P. Grobbelaar: Deputy Director (Summer Grain Centre - Potchefstroom)

Mr J. de Kock: Assistant Director (Summer Grain Centre - Potchefstroom) (1977-08-01)

Mr J.D. Basson: Deputy Director (Small Grain Centre - Bethlehem)

Mr G.J. Carstens: Assistant Director (Small Grain Centre - Bethlehem)

Mr K.W. Pakendorf: Assistant Director (Small Grain Centre - Bethlehem) (1977-08-31)

Dr J.J. Coetzee: Assistant Director (Extension)

Mr M.C. Walters: Assistant Director (Research)

Mr S.W.B. van Rensburg: Assistant Director (Administrative)

Grootfontein College of Agriculture. Research stations and experimental farms: Potchefstroom complex (central research station), Bethlehem and Swartrand (for gousiekte research) at Ventersdorp.

Karoo Region

Agricultural College, Grootfontein, Middelburg, CP

Dr P.W. Roux: Director

Mr C.R. Baard: Deputy Director

Mr J.A.A. Baard: Assistant Director (Research)

Dr A.J. Siepker: Assistant Director (Extension)

Grootfontein College of Agriculture. Research stations, experimental farms: Grootfontein, Middelburg, CP (central research station), Carnarvon, Tarka Conservation Area, Hales Flats and Jansenville

Natal Region

Private Bag X9021, Pietermaritzburg

Dr P. Hildyard: Director

Mr R.H. Peard: Deputy Director

Dr J.W.C. Mostert: Assistant Director (Research)

Dr D.M. Scotney: Assistant Director (Extension)

Cedara College of Agriculture. Research stations, experimental farms: Cedara (Central Research Institute), Drakensberg Complex, (Estcourt); Northern Natal (Dundee); Kokstad and Pongolapoort (Makatini).

South West Africa Region

Private Bag X13184, Windhoek

Dr L. Mostert: Director

Mr J.H. Loubser: Deputy Director

Mr C.H. de Klerk: Assistant Director (Extension)

Dr P.J. le Roux: Assistant Director (Research)

Neudam College of Agriculture. Research stations, experimental farms: Gellap 'Ost (Keetmanshoop), Hardap (Mariental), Kalahari (Stampriet), Neudam (Windhoek), Omatjenne (Otjiwarongo), Sandveld (Gobabis), Sonop (Grootfontein) and Uitkomst (Grootfontein).

Transvaal Region

Agrivaal Building, Cor Edmund and Hamilton Streets, Private Bag X180, Pretoria

Mr D.F. de Wet: Director

Mr S.J. Gericke: Deputy Director

Dr M.K.S.L. von La Chevallier: Assistant Director (Research)

Mr W.H. de Vos: Assistant Director (Extension)

Mr J.A. van Niekerk: Assistant Director (Administrative)

Research stations, experimental farms: Roodeplaat (central research station), Rietondale, Soutpan (Pretoria), Athole (Amsterdam), Loskop (Groblersdal), Mara (Louis Trichardt), Messina, Nooitgedacht (Ermelo) and Towoomba (Warm Baths).

Winter Rainfall Region

J.S. Marais Building, Private Bag X5023, Stellenbosch

Dr J.E. Erasmus: Director

Dr P.J.S. Pieterse: Deputy Director

Mr A. Viljoen: Deputy Director

Mr D.J. van Z. Smit: Assistant Director (Extension)

Mr H.C. du Preez: Assistant Director (Administrative)

Stellenbosch-Elensburg College of Agriculture. Research stations and experimental farms: Elensburg, Mariendal and Welgevallen (Stellenbosch), Langgewens (Moorreesburg), Nortier (Lambert's Bay), Oudsthoorn, Outeniqua (George), Tygerhoek (Riviersonderend) and the Veld Reserve at Worcester.

(2) ADVISORY PRODUCTION COMMITTEES

The following is a list of the various production committees operating in the Department. The committees consist of representatives of this department, other interested Departments, organized agriculture, the control boards and the various branches of the agricultural industry.

They were constituted for the purpose of creating liaison between the above-mentioned bodies, to solve problems arising in the different agricultural industries and to promote production.

Most of these committees are reconstituted every three years.

A. PLANT PRODUCTION

1. ADVISORY COMMITTEE FOR COFFEE PRODUCTION

Department of Agricultural Technical Services

Dr J.H. Grobler (Chairman)

Mr R.H. Peard

Department of Agricultural Economics and Marketing

Mr J. de J. Jooste

Department of Plural Relations and Development

Mr J.J. Lutz

Department of Commerce

Mr J. Jooste

Coffee Growers Association of South Africa

Dr G.H. Shuker

Mr P. Mayne

Mr E.W. Steward

South African Tea, Coffee and

Chicory Association

Mr O.P. Kelly

2. ADVISORY COMMITTEE FOR PINEAPPLE PRODUCTION

Department of Agricultural Technical Services

Dr J.H. Grobler (Chairman)

Mr J.H. Stapelberg

Mr R.H. Peard

Dr G.J. Eksteen

Department of Agricultural Economics and Marketing

Mr F.J. le Roux

Perishable Products Export Control Board

Mr J.M. Bester

Fruit and Vegetable Canners Association of SA

Mr J.R. Burg

South African Agricultural Union

Dr G. Marr

Mr C. Tilney

Mr A.A. Bisschoff

Mr J.H. Gauche

Mr L. Hartman

3. ADVISORY COMMITTEE FOR CITRUS PRODUCTION

Department of Agricultural Technical Services

Dr J.H. Grobler (Chairman)

Dr I.H. Wiese

Mr A. van Oostrum

Mr J.H. Stapelberg

Mr S.J. Gericke

Dr G.J. Eksteen

Citrus Board
Mr D.C. Lötter
Mr N.C. Lodewijks
Mr D. Raubenheimer
Dr D.A. Stanton
Mr M.B. Georgala
Mr G.F. Malan (M.P.)
Mr T.F.S. Malherbe
Mr P.J. van Baalen

South African Agricultural Union
Mr F. Weyer

Economic Development Corporation
Dr D. Bester

University of Pretoria
Dr L.C. Holtzhausen

Perishable Products Export Control Board
Mr J.M. Bester

4. ADVISORY COMMITTEE FOR DECIDUOUS FRUIT PRODUCTION

Department of Agricultural Technical Services
Dr P.G. Marais (Chairman)
Dr J. de V. Burger
Mr E. Strydom
Mr A. Kriel

Deciduous Fruit Board
Mr G.D. Kilpin
Mr A. van Niekerk
Mr G.C. Burger

South African Agricultural Union
Mr H.J. Lighthelm
Mr H.J. van Niekerk
Mr W.T. Stewart
Mr F.S. Nel

Dried Fruit Board
Mr D.C. Viljoen

SA Fruit and Vegetable Canners Association
Mr H.J. Visagie

Perishable Products Export Control Board
Mr J.M. Bester

Canning Fruit Control Board
Mr A.S. von M. Fullard

Cape Pomological Association
Mr R. Dalton

University of Stellenbosch
Prof. D.K. Strydom

5. ADVISORY COMMITTEE FOR FOOD TECHNOLOGICAL MATTERS

Department of Agricultural Technical Services
Dr P.G. Marais (Chairman)
Dr J.H. Grobler

University of Stellenbosch
Prof. B.H. Koeppen

Department of Agricultural Economics and Marketing
Mr F.J. le Roux

Department of Health
Dr P.N. Swanepoel

Council for Scientific and Industrial Research
Mr J.P. de Wit

Deciduous Fruit Board
Mr G.D. Kilpin

South African Agricultural Union
Mr H.B. Lombaard

Apricot, Pear and Peach Producers Association
Mr A.S. Fullard

SA Fruit and Vegetable Canners Association
Mr N. Goosen
Mr J. Lombard
Mr S. Wood

SA Citrus Juice Manufacturers and Exporters Association
Mr M. Wall

Dried Fruit Board
Mr D.C. Viljoen

SA Federated Chamber of Industries
Mr E.R. Newbery

Citrus Board
Mr A.F.G. Smith

Metal Box South Africa Ltd
Mr J.H. Hofmeyr

6. ADVISORY COMMITTEE FOR WINE GRAPE CULTIVATION AND WINE PRODUCTION

Department of Agricultural Technical Services
Dr J.D. Burger (Chairman)
Dr A.J. Heyns
Mr G.W. Oosthuizen
Mr J.J. Bruwer
Mr A.F. Kriel

KWV
Mr L.N. Jonker
Mr P.B.B. Hugo
Mr W.J. van Zyl
Mr W.S. Smit
Dr J.A. van Zyl

Cape Wine and Spirits Institute
Mr R.R. Melck
Mr H.M.E. Flockman
Dr P.J. Venter

Dried Fruit Board
Mr D.C. Viljoen

Stellenbosch Estates Wines (Coop.) Ltd.
Mr F.J. Malan

Cooperative Wine Cellars Committee
Mr J.S. Odendaal

Coordinating Committee of the Western Cape Growers Association
Mr H.F. Smit

University of Stellenbosch
Prof. C.J. Orffer
Prof. C.J. van Wyk

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert

7. ADVISORY COMMITTEE FOR TOBACCO PRODUCTION

Department of Agricultural Technical Services
Dr A.J. Pienaar (Acting Chairman)

Tobacco Board
Mr E.C. Schutte

Central Cooperative Tobacco Company of SA Ltd.
Mr A.J. de Jager
Mr J.A. Opperman
Dr W.R. Kolver
Mr J.W. Louw
Mr J.D.R. Henstock
Mr T.F. van der Merwe
Mr S.A. de Kock

Tobacco Manufacturers Committee
Mr V.I. Breytenbach

Member appointed by the Minister
Dr F.W. van Zyl

8. ADVISORY COMMITTEE FOR BANANA PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Grobler (Chairman)
Mr S.J. Gericke
Dr P. Hildyard

South African Agricultural Union
Mr M. Tooley
Mr P.E.R. Redelinghuys

Banana Control Board
Mr J.B. Bester
Col. C.J. Huyzers S.M.
Mr J.R. Minnaar

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert

9. ADVISORY COMMITTEE FOR DRY BEAN PRODUCTION

Department of Agricultural Technical Services
Dr A.J. Pienaar (Chairman)
Dr J.W. Snyman
Mr A.J. Liebenberg
Mr D.F. de Wet

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

South African Agricultural Union
Mr J.J. van Wyk
Mr H.J. Engelbrecht
Mr J.J. van Rooyen

SA Fruit and Vegetable Canners Association
Mr R.O. Brown

Dry Bean Control Board
Mr L.B. Rothman
Mr C.F. Bezuidenhout

Council for Scientific and Industrial Research
Mr J.P. de Wit

10. ADVISORY COMMITTEE FOR POTATO PRODUCTION

Department of Agricultural Technical Services
Mr D.F. de Wet (Chairman)
Mr F.I. du Plooy
Mr D.C. Lourens
Dr J.E. van der Plank

Potato Board
Mr P.L. Steyn
Mr P.J. Farrel

Seed Potato Producers Union
Mr T. Cook
Mr D.J. van Rensburg

The SA Fertilizer Society
Mr O.G. Smith

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert

South African Agricultural Union
Mr M.F. Crick
Mr H.J. Pieterse

11. ADVISORY COMMITTEE FOR SUMMER GRAIN PRODUCTION

Department of Agricultural Technical Services
Dr A.J. Pienaar (Chairman)
Dr J.D. Slabber
Dr P. Hildyard
Dr W.P. Grobbelaar

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

Maize Board
Mr B. Wilkens
Mr H.F.B. Hickley

SA Fertilizer Association
Mr G.C.H. Venter

South African Agricultural Union
Mr M.D.F.H. van der Hoven
Mr M. Daling

Transvaal Agricultural Union
Mr J.T. van Eeden

OFS Agricultural Union
Mr W.M. Leonard

Sentraal Westelike Koöperasie
Mr J.C. Steyn

Oostelike Transvaalse Koöperasie
Mr D. de Wet

Noordwes Koöperasie
Dr A. Scholtz

12. ADVISORY COMMITTEE FOR SMALL GRAIN PRODUCTION

Department of Agricultural Technical Services
Dr A.J. Pienaar (Chairman)
Mr J.D. Basson
Dr J.E. Erasmus
Mr D.F. de Wet
Dr J.D. Slabber

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert

Wheat Board
Mr H.H. Klerck
Mr D.F. van Aarde

South African Agricultural Union
Mr H.J. Truter
Mr A.B.J. van der Merwe
Mr D.M. Grewar
Mr M. Daling
Mr F.L. Slabbert

SA Fertilizer Association
Mr F.J. Dijkhuis

13. ADVISORY COMMITTEE FOR AVOCADO PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Grobler (Chairman)
Mr A. van Oostrum
Mr S.J. Gericke
Dr G.J. Eksteen

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert
Mr F.J. le Roux

South African Agricultural Union
Mr H.J. van Aswegen
Mr J.A. Cumming
Mr P.W. de W. Wessels
Dr B.N. Wolstenholme

Avocado Growers Association of South Africa
Mr J.P. Hughes
Mr F.J. Lourens
Mr C. Wheatley

Perishable Products Export Control Board
Mr J.M. Bester

B. ANIMAL PRODUCTION

1. ADVISORY COMMITTEE FOR KARAKUL SHEEP PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr L. Mostert

Dr A.J.J. Meyer
Mr D. Boshoff

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

Agricultural Union of South West Africa
Mr W.H. Barnard
Mr J.J. Gous

Karakul Board
Dr A.J.A. van Niekerk

Karakul Breeders' Association of SA
Mr F. Shamley

2. ADVISORY COMMITTEE FOR PIG MEAT PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr P.P. Bosman

Department of Agricultural Economics and Marketing
Mr J. de J. Jooste

SA Pig Development Association
Mr S. Saffer
Dr W.A. Vosloo

Meat Board
Mr G.H. Braak
Mr P.J. Pretorius

SA Pig Breeders' Society
Mr A. Webber

South African Agricultural Union
Mr J.B. Haasbroek

3. ADVISORY COMMITTEE FOR POULTRY PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr P. Bosman

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert

Egg Board
Mr M. Oosthuizen

SA Poultry Association
Mr R. Horn
Dr G. Faber

South African Agricultural Union
Mr A.E. Karlsen

4. ADVISORY COMMITTEE FOR PIG TESTING

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr P.P. Bosman

SA Pig Breeders' Society
Mr R. Barnes

Meat Board
Mr G.H. Braak

Pig Industry Committee
Mr S. Saffer

5. ADVISORY COMMITTEE FOR RANDOMISED EGG-LAYING AND BROILER TESTS

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Mr W.C.J. Viljoen
Dr P. Bosman

SA Poultry Association
Mr J. Serfontein
Mr A.L. McCarthy
Mr J. Mirvish
Dr G. Faber
Mr M. Oosthuizen

South African Agricultural Union
Mr J.H. du Plessis

6. ADVISORY COMMITTEE FOR THE NATIONAL BEEF CATTLE PERFORMANCE AND PROGENY TESTING SCHEME

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. van der Merwe

South African Agricultural Union
Mr P.R. du Toit

Meat Board
Mr S.J.J. van Rensburg
Mr A.P. Pretorius
Mr A.E. Hambly
Mr J.F. Vercueil

South African Stud Book Association
Mr R.J. Theunissen
Mr A.R.D. Halse

7. ADVISORY COMMITTEE FOR PERFORMANCE TESTING OF SHEEP AND GOATS

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)

SA Stud Book Association
Mr A.R.D. Halse
Mr Dodds Pringle

Meat Board
Mr A.M. Wessels

Merino Stud Breeders' Society of SA
Mr O.J.M. van den Heever

SA Wool Board
Mr H.F. Prinsloo

Karakul Breeders' Society of SA
Dr S.J. Schoeman

The South African Federation of Livestock Breeding Groups
Dr C.A. van der Merwe

The Angora Goat Stud Breeders' Society
Mr P.L. Cawood

The Boer Goat Breeders' Society of South Africa
Mr S.W. Malan

8. ADVISORY COMMITTEE FOR DAIRY PRODUCTION AND TECHNOLOGY

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.C. Oosthuizen

Department of Agricultural Economics and Marketing
Mr J.P. van der Walt

Dairy Products Manufacturers Association
Mr L. Stein
Dr M.N. Hermann

Dairy Board
Mr P.J.H. Maree

Milk Board
Mr A.C. Visser

SA Dairy Technology Association
Mr P.H. Lishman

Milk Distributors Association of SA
Mr J.D. Nel

SA Agricultural Union
Dr L. Theron
Mr J.J.M.J. van Vuuren

9. ADVISORY COMMITTEE FOR THE PRODUCTION OF WOOL

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr W.J. Hugo
Dr J.P. van der Merwe

Department of Plural Relations and Development
Mr W.F. Waugh

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

SA Wool Board
Mr H.F. Prinsloo

National Wool Growers' Association
Mr P.W. van Rooyen

SA Wool and Mohair Buyers Federation
Mr R.D.L. Davis

SA Wool and Mohair Brokers Association
Mr N.J. Vlok

SA Wool and Textile Research Institute
Dr D.P. Veldsman

Merino Stud Breeders' Society of SA
Mr O.J.M. van den Heever

10. ADVISORY COMMITTEE FOR MILK RECORDING

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Mr J.S.A. Landrey

Central Milk Recording Cooperative
Mr D. Houston
Mr B. Newcombe
Mr W.A. Patterson

SA Stud Book Association (Milk Breeds)
Mr T.E.M. Murray

Artificial Insemination Cooperatives
Dr C.T. McDonald

Milk Board
Mr E.J.W. Quin

Dairy Board
Mr P.E. Roux

South African Agricultural Union
Mr P.L. Barnard

11. ADVISORY COMMITTEE FOR MOHAIR PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. van der Merwe
Dr P.W. Roux

Department of Agricultural Economics and Marketing
Mr J. de J. Jooste

SA Wool Textile Research Institute
Dr D.P. Veldsman

SA Mohair Production Association
Mr J.F. Froehlich

Mohair Board
Mr D.A. Hobson
Mr H.H. Coetzer

Angora Stud Breeders' Society of South Africa
Mr J.D.D. Kettlewell

12. ADVISORY COMMITTEE FOR BEEF, MUTTON AND GOAT MEAT PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. van der Merwe
Dr L. Mostert

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

Department of Plural Relations and Development
Mr W.F. Waugh

Meat Board
Mr S.J.J. van Rensburg
Mr J.J. Reyneke
Mr R.J. Theunissen
Mr P.J. Pretorius
Dr J.H. Lombard
Mr A.P. Pretorius

South African Agricultural Union
Mr P.R. du Toit
Mr J.P. Smit
Dr J.S. Starke
Mr F.P. Möller

SA Abattoir Corporation
Mr B.J. Kruger

13. ADVISORY COMMITTEE FOR DAIRY BULL TESTING

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Mr J.S.A. Landrey

Friesland Cattle Breeders' Society of South Africa
Mr T.E.M. Murray

Ayrshire Cattle Breeders' Association of SA
Mr J.M. Walker

SA Guernsey Cattle Breeders' Society
Mr D.C. Hart

Jersey Cattle Breeders' Society of South Africa
Mr H.M. de Villiers

Artificial Insemination Co-operatives
Dr C.T. McDonald
Dr A.B. le Grange

Central Milk Recording Co-operative
Mr P.L. Barnard

14. ADVISORY COMMITTEE ON THE ANIMAL SLAUGHTER, MEAT AND ANIMAL PRODUCTS HYGIENE ACT

Department of Agricultural Technical Services
Dr J.P. van der Merwe (Chairman)
Dr J. Coetzee
Mr C.S. de Villiers

Department of Agricultural Economics and Marketing
Mr J.P. van der Walt

Department of Health
Dr J.G. Oberholster

Meat Board
Mr G.H. Braak
Mr G.N. Gluckman
Mr S.J.J. van Rensburg

United Municipal Executive of SA
Dr C.R. Mackenzie

SA Veterinary Society
Dr M.M. Greathead

C. STATUTORY BOARDS

1. ADVISORY COMMITTEE FOR ANIMAL PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Hofmeyr (Chairman)
Dr J.P. van der Merwe
Dr B.C. Jansen
Mr C.S. de Villiers

Department of Agricultural Economics and Marketing
Mr H.S. Hattingh

Insemina Co-op Ltd
Dr A.B. la Grange

SA Poultry Association
Dr G.L. Faber

SA Agricultural Union
Mr J.P. Swart

Milk Board
Mr B. Davidsz

Manufacturers of Balanced Stock Feed
Dr D.G. Mordant

Karakul Board
Mr A.J.A. van Niekerk

Mohair Board
Mr D.S. Uys

SA Veterinary Society
Dr A.P. Schutte

SA Stud Book Society
Mr T.E.M. Murray

SA Wool Board
Mr H.F. Prinsloo

SA Society of Animal Production
Dr J. van Marle

Dairy Board
Mr W.J. Basson

Meat Board
Mr P.R. du Toit

2. VETERINARY BOARD

Department of Agricultural Technical Services
Dr B.C. Jansen (Chairman)
Mr C.S. de Villiers

University of Pretoria
Prof. C.F.B. Hofmeyr

SA Veterinary Society
Dr R.I. Coubrough
Prof. L.W. van den Heever
Prof. H.P.A. de Boom

Chief Magistrate
Mr M.J. Prins

D. OTHER ADVISORY COMMITTEES

1. ADVISORY COMMITTEE FOR THE TESTING OF AGRICULTURAL ENGINEERING EQUIPMENT

Department of Agricultural Technical Services
Mr J.J. Bruwer (Chairman)
Mr C.T. Crosby
Dr B. van D. Boshoff

Department of Agricultural Economics and Marketing
Mr G. Ortmann

South African Agricultural Union
Mr J.J.A. van Wyk
Mr W.T. Cloete
Mr C.J. Bader
Dr A.G. de Beer
Mr D.J. Visser
Mr S.J. Schoeman

SA Agricultural and Irrigation Machinery
Manufacturers Association
Mr T. Kenedi

SA Institute of Agricultural Engineers
Prof. P.J.C. Vorster

National Agricultural Machinery Traders Association
Mr A. von Eckardstein

CSIR
Dr H.G. Denkhaus

SA Bureau of Standards
Mr P. Scribante

University of Pretoria
Prof. B.J.G.W. Grobler

University of Natal
Prof. P. Meiring

University of Fort Hare
Prof. M.D. Radford

SA Tractor Manufacturers' Association
Mr J.J. Oosthuizen

Liaison Committee for Test Entrants
Mr J.E. Rossiter

2. ADVISORY COMMITTEE FOR BEE-KEEPING

Department of Agricultural Technical Services
Dr I.H. Wiese (Chairman)
Dr R.M. Anderson
Dr D.J.C. Fletcher

Department of Agricultural Economics and Marketing
Mr P.J. Wessels

Department of Forestry
Mr M. van N. Möhr

SA Federation of Bee-Keepers Association
Mr R. Guy
Maj.-Gen. G.D. Moodie
Mr K. Voges
Mr P.M. Mountain
Mr J. Smith
Mr F. Steinhobel
Mr G. Altona
Mr T.G. Bester

3. ADVISORY COMMITTEE FOR BOTANICAL RESEARCH

Department of Agricultural Technical Services
Dr B. de Winter (Chairman)
Dr D.J.B. Killick
Dr D. Edwards

Department of Forestry
Dr H.A. Lückhoff

National Botanical Gardens of South Africa
Prof. H.B. Rycroft

National Parks Board of Trustees
Mr P. van Wyk

Interprovincial Nature Conservation Committee
Mr P. le Roux

SA Association of Botanists
Prof. O.A. Lewis
Prof. H.M. van der Schyff
Prof. C.F. Cresswell
Prof. N. Grobbelaar
Prof. E.A. Schelpe
Prof. M.C. Papendorf

4. ADVISORY COMMITTEE FOR THE TRAINING OF PROSPECTIVE FARMERS

Department of Agricultural Technical Services
Dr D.J. Agenbach (Chairman)
Dr J.E. Erasmus
Dr J.D. Slabber
Dr W.J. Hugo
Dr P. Hildyard
Dr L. Mostert
Dr P.W. Roux

SA Agricultural Union
Mr A.J. Basson
Mr J. Wilkens

Department of National Education
Mr J.H. Swiegers

Department of Agricultural Economics and Marketing
Mr J.S.G. Joubert

**5. ADVISORY COMMITTEE REGARDING
RESEARCH GRANTS BY THE DEPARTMENT
OF AGRICULTURAL TECHNICAL
SERVICES TO UNIVERSITIES**

Department of Agricultural Technical Services
Dr J.C. Strydom (Chairman)
Dr B.C. Jansen
Prof. S.A. Hulme

Office of the Scientific Adviser to
the Prime Minister
Dr C.G. Coetzee

University of Stellenbosch
Prof. H.A. Louw

University of the OFS
Prof. H.A. Kotze

University of Natal
Prof. W.J. Stielau

University of Pretoria
Prof. C.F.B. Hofmeyr
Prof. D.J.J. Potgieter

University of Rhodes
Prof. D.R. Woods

University of Potchefstroom
Prof. H.J. von M. Harmse

University of Cape Town
Prof. J. Terblanche

6. SOIL PROTECTION ADVISORY BOARD

Department of Agricultural Technical Services
Dr D.J. Agenbach (Chairman)
Dr J. Serfontein

Representatives of Regional Advisory Committees
Mr M.G. Reynolds
Mr T.F. Dreyer
Mr J.A. Jooste
Mr H.P. van der Walt
Mr M. Melck
Mr T.N. van Lill
Mr C.J. Grobler
Mr J.J. du Plessis

SA Agricultural Union
Mr H.P. van Jaarsveld

Nominated by the Minister of Agriculture
Mr W.C. van der Heever

**7. SELECTION COMMITTEE FOR THE
IMPORT OF DECIDUOUS FRUIT CULTIVARS**

Department of Agricultural Technical Services
Dr P.G. Marais (Chairman)
Mr J.N. Horn
Mr H.P. van Heerden
Mr D.J. Engelbrecht
Dr J.T. Meynhardt

Canning Fruit Board
Mr A.S. von M. Fullard

University of Stellenbosch
Prof. D.K. Strydom

Cape Pomological Society
Mr R. Dalton

Deciduous Fruit Board
Mr G.D. Kilpin

Dried Fruit Board
Mr C.P. du Plessis

SA Organisation for Fruit Plant Improvement
Mr J.L.B. du Toit

SA Nurserymen's Association
Mr H.P. du Preez

**8. COORDINATING COMMITTEE FOR THE
EVALUATION OF WINE CULTIVARS**

Department of Agricultural Technical Services
Dr J. de V. Burger (Chairman)
Dr J. Deist
Mr H.P. van Heerden
Mr D.J. Engelbrecht
Mr A.F. Kriel

University of Stellenbosch
Prof. C.J. Orffer

Cape Wine and Spirits Institute
Mr A. Kriel
Dr P.J. Venter

KWV
Dr J.A. van Zyl
Dr E.F. Beukman

Cape Estates Wine Producers Association
Mr F.J. Malan

Coordinating Committee of the Western Cape Growers
Association
Mr H.F. Smit

Dried Fruit Board
Mr D.C. Viljoen

E. LIAISON COMMITTEES

**1. LIAISON COMMITTEE: AGRICULTURAL
TECHNICAL SERVICES/SA FERTILISER
ASSOCIATION**

Department of Agricultural Technical Services
Dr D.W. Immelman
Prof. S.A. Hulme
Dr B.C. Jansen

SA Fertilizer Association
Mr J.G. Norton
Mr A.G. de M. du Toit
Dr H.C. Luitingh
Mr R. du Toit
Mr S.A.G. Anderson

**2. LIAISON COMMITTEE: AGRICULTURAL
TECHNICAL SERVICES/SOUTH AFRICAN
AGRICULTURAL UNION**

Department of Agricultural Technical Services
Dr W.A. Verbeek
Dr D.W. Immelman
Dr J.D. Slabber
Mr B.W. Viljoen
Mr C.S. de Villiers
Mr J.J. Bruwer

South African Agricultural Union
Mr A.J. Basson
Mr J. Wilkens
Mr S.J.J. van Rensburg
Mr C.J.P. Cilliers
Mr P.H. Swart

**3. LIAISON COMMITTEE: AGRICULTURAL
TECHNICAL SERVICES/COUNCIL FOR SCIENTIFIC
AND INDUSTRIAL RESEARCH**

Department of Agricultural Technical Services
Dr W.A. Verbeek
Dr B.C. Jansen

Council for Scientific and Industrial Research
Dr C. v.d. M. Brink
Dr A.P. Burger

4. TECHNICAL LIAISON COMMITTEE FOR TEA PRODUCTION

Department of Agricultural Technical Services
Dr J.H. Grobler (Chairman)

Department of Plural Relations and Development
Mr J.J. Lütz

Tea Producers
Mr D.J. Penwill
Dr P.P. du T. Deetlefs

5. LIAISON COMMITTEE: AGRICULTURAL TECHNICAL SERVICES/PLURAL RELATIONS AND DEVELOPMENT

Department of Agricultural Technical Services
Prof. S.A. Hulme (Chairman)
Dr B.C. Jansen

Department of Plural Relations and Development
Dr H. Hamburger
Mr G. van de Wall

6. LIAISON COMMITTEE: AGRICULTURAL TECHNICAL SERVICES/SENTRALE SAAD-KWEKERSKOÖPERASIE BEPERK

Department of Agricultural Technical Services
Dr W.A. Verbeek
Prof. S.A. Hulme

Dr A.J. Pienaar
Mr E. Strydom
Mr J.F. van Wyk

Sentrale Saadkwekerskoöperasie Bpk
Mr G.J. Wentzel
Mr B.J. Vorster
Dr P.J. Möhr
Dr A.J.L. du Toit
Dr J.P. Jordaan

7. LIAISON COMMITTEE: AGRICULTURAL TECHNICAL SERVICES/NATIONAL BOTANIC GARDENS

Department of Agricultural Technical Services
Prof. S.A. Hulme (Chairman)
Dr B. de Winter
Mr L.J. Botha

National Botanic Gardens of SA
Mr C.J.F. Human
Prof. P.G. Jordaan
Prof. H.B. Rycroft
Mr P.J. Grobler

(3) AGRICULTURAL TECHNICAL RELATIONS WITH FOREIGN COUNTRIES

CO-OPERATION WITH AFRICAN COUNTRIES

SARCCUS conferences and meetings attended

Nature of meeting	Time	Place	SA delegates
Standing Committee for Soil Conservation and Land Use Planning	1977-09-27 to 1977-09-30	Stellenbosch	Mr R.W. Nott Dr D.M. Scotney Dr H.C. Hahne Dr A.L. du Pisani Dr B. v.d. Boshoff
Standing Committee for Education and Extension	1977-10-12 to 1977-10-14	Pretoria	Dr N.J. Robbertse
Standing Committee for Nature Conservation, Wild Life Utilisation and Control	1977-10-31 to 1977-11-04	Charter's Creek, Natal	Dr J.P. van der Merwe
Standing Committee for Animal Production	1977-11-12 to 1977-11-17	Lilongwe, Malawi	Dr J.H. Hofmeyr Dr J.G. Cloete
Standing Committee for Soil Science	1978-02-22 to 1978-02-24	Pretoria	Dr C.N. MacVicar Mr R.W. Nott
16th General Meeting of SARCCUS	1978-05-08 to 1978-05-13	Skukuza	Prof S.A. Hulme Dr J.H. Hofmeyr Dr D.M. Scotney Mr H.P. van Heerden Dr J.P. v.d. Merwe
Subcommittee for Land Use Planning and Erosion Control	1977-08-08 to 1977-08-10	Durban	Dr D.M. Scotney
Subcommittee for Aquatic Weeds	1977-09-19	Pretoria	Dr D. Edwards
Meeting for the establishment of the Subcommittee for Remote Sensing	1977-11-09 to 1977-11-10	Lilongwe, Malawi	Dr D. Edwards Mr J.F. Eloff

Visitors from African Countries

Name of visitor	Country and institution	Period of visit	Purpose of visit	Institution visited
Mbokodi, P.M.	Officer from Transkei	1977-11-24	Fact finding on the problem of disease control and the movement of livestock	Veterinary Services
Morriss, K.H. (Dr)	Swaziland (Gaborone; Attached to the Ministry of Agriculture, Swaziland)	1978-05-08 to 1978-05-12	Discussions	Citrus and Horticulture
Rhodesian officers (two)	Rhodesia (Members of the Rhodesian Department of Soil Conservation)	1977-10-27	Discussions	Agricultural Information
Dr. A. Wilson and Dr J.W. Thompson	Rhodesia (Director and Deputy Director of the Rhodesian Veterinary Service)	1978-03-10	Discussions of disease control measures and the importation of animals	Veterinary Services
Dr W. Purves	Rhodesia (Department of Agriculture, Salisbury)	1977-08-19	Discussion	Soil and Irrigation Research Institute

Visitors to African Countries

Purpose of visit	Date	Place	Name of officer
To attend the Fourth Rhodesian Science Congress in Bulawayo and deliver a paper	1977-09-05 to 1977-09-07	Rhodesia	Dr C.N. MacVicar
Discussions on the establishment of a plant and seed inspection service and advice on legislation in this regard	3 days 1977	Transkei	Mr J.F. van Wyk
To attend the Fourth Rhodesian Science Congress and pay a three days' visit to Rhodesian research stations that undertake research on soil losses	1978-09-01 to 1978-09-07	Rhodesia	R.I. Jones
To attend a meeting of the SARCCUS Standing Committee for Animal Health and Animal Production	1977-11-12 to 1977-11-17	Malawi	Dr L. Mostert Dr J.H. Hofmeyr Dr J.G. Cloete Dr J.P. van der Merwe Dr J.M. Erasmus Dr C. van N. Jonker
Five days' visit to obtain information on tobacco growing	5 days December 1977	Rhodesia	Mr J. Fuls
To visit Malawi in an advisory capacity in connection with tobacco growing	1977-12-11 to 1977-12-15	Malawi	Mr J.F. Peens
Study tour on the meat classification system and its application	1978-01-30 to 1978-02-03	Rhodesia	Mr J.F.G. Klingbiel
To assist with the equipping of Miss Flattery's laboratory	5 days 1977	Botswana	Dr V.H. Whitlock
To attend the SARCCUS meeting on Remote Sensing	1977-11-09 to 1977-11-10	Malawi	Dr D. Edwards Dr R.J. le Roux Mr J.F. Eloff
To obtain information on fish farming	3 days 1977	Lesotho	Mr J.S. Leonard Dr D.J.B. Killick Dr R. Magill
Plant collecting trip	1977-11-28 to 1977-12-16	Transkei Lesotho	Mr T.B. Vorster Mr P.C.V. du Toit Mr R.P. Ellis
Inspection of seed potatoes at Umzimkulu	1 day	Transkei	Mr H.J. Human
To visit all the SARMEIT trials	10 days, 1978	Malawi Rhodesia Botswana Lesotho Swaziland	Dr H.C. Kühn
To attend the annual meeting of the Red Locust Control Organisation	1978-03-06 to 1978-03-07	Rhodesia	Dr I.H. Wiese Dr H.D. Brown Mr L.J. Botha
To assist with the control of Newcastle disease in Malawi	1978-01-31 to 1978-02-07	Malawi	Dr S.B. Buys
To inspect export abattoirs	1977-07-18 to 1977-07-29	Rhodesia	Dr A.E. Gillespie
	1978-03-06 to 1978-03-07	Botswana	Dr G.J.H. Stevens
	1978-03-12 to 1978-03-14	Swaziland	Dr G.J.H. Stevens

Congresses, meetings and symposia

Overseas Visits	Period	Place	SA delegate
To attend a horticultural symposium in Ghent	4 days, 1977	Belgium	Mrs D.D. Nel
To attend a symposium on strategy and tactics in the control of migratory pests	1977-06-26 to 1977-07-17	England Italy	Dr H.D. Brown

Overseas visits	Period	Place	SA delegate
To attend a symposium on calcium feeding	1977-10-04 to 1977-10-07	USA	Dr J.H. Terblanche
To attend an ACTIM symposium on irrigation	1977-08-27 to 1977-09-16	France	Dr A.D. Nieuwoudt Dr E. Verster Dr A. Streutker Mr I. Scheepers Mr F. Geertsema
To attend the International Symposium on the Environmental Consequences of Fire and Field Management in the Mediterranean Climates Ecosystem	1977-07-29 to 1977-09-04	USA	Mr H.C. Taylor
To attend a symposium on irrigation	1977-10-27 to 1977-11-12	Iran	Dr P.F. Fuls
To attend an international symposium on mechanical milking	1978-02-09 to 1978-03-02	USA	Mr J. Veenstra
To attend the UPOV meeting	1977-12-06 to 1977-12-09	Switzerland	Mr J.F. van Wyk
To attend the AETFAT symposium and read a paper	1978-03-18 to 1978-03-23	Las Palmas Spain	Mr C.H. Stirton
To attend the meeting of the OIV's Specialist Committee on Table Grapes	1977-10-12 to 1977-10-14	France	Mr L. Ginsburg
To attend the annual meeting of the OECD's seed certification authorities	1978-04-26 to 1978-04-30	France	Mr L.J. Grobler
To attend the annual congress of the OIE on animal health	1978-05-20 to 1978-05-28	France	Dr J.P. van der Merwe
To attend the subcommittee meetings of the OIV and the meeting of the specialist group on oenology	1978-05-20 to 1978-05-29	France	Dr C.S. du Plessis
To attend the congress of the International Society of Soil Science	1978-06-15 to 1978-07-15	Canada	Mr J.E. Volschenk
To attend an international course on agricultural extension	8 days June/July 1978	The Netherlands England	Mr W.H. de Vos
To attend the international symposium on biological nitrogen fixing in Madison, Wisconsin, and read a paper	1978-06-12 to 1978-06-22	USA	Dr B.W. Strydom
To attend the ISTA workshop	1978-05-23 to 1978-06-03	The Netherlands	Miss E. Robert
To attend the Israqua Conference in Tel Aviv and an irrigation workshop in the USA	1978-06-04 to 1978-07-29	Israel USA	Mr J. Eckard
To attend the 11th Congress of the International Society of Soil Science	1978-06-05 to 1978-07-07	Canada	Mr R.W. Nott
To attend the 62nd annual meeting of the International Dairy Federation and the 20th International Dairy Congress	1978-06-17 to 1978-07-07	France England	Dr J.C. Oosthuizen
To attend the international agricultural show in Frankfurt-Maine at the expense and invitation of LAV	1978-04-28 to 1978-05-04	Germany	Mr J.J. Bruwer
To attend the 11th Soil Science Congress in Canada and the 6th International Clay Congress in Scotland	1978-06-16 to 1978-07-15	Canada Scotland	Mr R.W. Fitzpatrick
To attend the AETFAT congress	1978-03-15 to 1978-03-27	Portugal, Las Palmas	Dr B. de Winter
To attend the 5th International Oenological Symposium in Auckland, New Zealand and collect information on wine-making procedures and cultivar wines	1978-01-18 to 1978-02-20	New Zealand and Australia	Mr G.W.W. Wagener

Study tours and official visits

Purpose of visit	Date	Place	SA Officer
Study tour on jaagsiekte and cancer viruses	1977-06-26 to 1977-08-26	Germany England Iceland The Netherlands Switzerland USA	Dr D.W. Verwoerd
To investigate the latest developments in the field of stock feed processing and gain practical experience in the application of these principles	30 days, 1977	Holland France Germany Switzerland Austria and Hungary	Mr J. de Szabo
Study tour on red locusts	1977-06-27 to 1977-07-17	England Italy	Dr H.D. Brown
Study tour to learn more about bitter pit research in apples	1977-10-02 to 1977-10-29	USA	Dr J.H. Terblanche
28 days' study tour to gain more information on pineapple research	1977-06-22 to 1977-08-20	Australia Hawaii USA	Dr D.P. Keetch
To investigate the system and organisation of the central development laboratory for the purchasing of milk on a quality basis	1977-05-24 to 1977-06-23	England Denmark Germany Holland Belgium France Switzerland	Prof A. Dixon
Study tour on sunflower cultivation	1977-07-31 to 1977-09-13	USA Canada	Mr E.B. Birch
Study tour to CIMMYT, Mexico, to obtain information on wheat	90 days, February March, April	Mexico USA	Mr I.B.J. Smit Mr C.F. Quass
To accompany a consignment of avocados to Southampton by sea and then to the marketing points, and analyse samples collected during the voyage	1977-05-24 to 1977-07-01	Britain	Mr D.H. Swarts
Study tour on the seed potato industry, potato diseases and late blight prediction in the USA	1977-09-17 to 1977-10-26	USA Britain	Mr B.W. Young
Study tour on the consequences of veld fires	1977-07-29 to 1977-09-04	USA Chile	Mr H.C. Taylor
To visit British authorities in connection with a consignment of canned meat	1977-08-11 to 1977-08-18	England	Dr J.D. Coetzee
26 day visit to discuss several aspects of soil conservation with specialists and study procedures and projects	1977-09-30 to 1977-10-27	USA	Mr H.S. Niehaus
Study tour on irrigation	1977-10-27 to 1977-11-11	Iran	Dr P.F. Fuls
To accompany officers from Sentrachem to obtain information on the treatment of plant residues with caustic soda	2 weeks, 1977	England Germany Scandinavia	Dr H.S. Hofmeyr
To visit research institutes in connection with feeding and roughage	13 days in 1977 while on leave	Britain USA	Dr P.J.K. Morgan

Purpose of visit	Date	Places	SA Officer
Study tour on mechanical milking and visits to universities and institutes in this connection	1978-02-09- to 1978-03-02	USA	Mr J. Veenstra
Study tour on soil science	1978-06-15 to 1978-07-15	USA Canada The Netherlands	Mr J.E. Volschenk
Study tour for the purpose of an in-depth investigation into the latest methods and organisation with regard to analytical services and facilities for handling large numbers of samples and interpreting the results for agriculture	1978-06-15 to 1978-07-15	Holland USA	Mr C.P. de L Beyers
Study tour to visit research institutes and study their composition and functioning	1978-05-27 to 1978-07-30	France Holland England Israel	Dr P.G. Marais
Study tour to investigate soil survey procedures and the resource data bank, and to attend the congress of the International Society of Soil Science	28 days, June/July 1978	USA Canada	Dr C.N. MacVicar
Visit to a nitrogen inoculant company	1978-06-12 to 1978-06-22	USA	Dr B.W. Strydom
Study tour on seed testing	19 days, May to June 1978	The Netherlands	Miss E. Robert
Study tour on in-service training systems for extension staff	1978-06-28 to 1978-07-25	Israel, Sweden, England, the Netherlands and Germany	Dr N.J. Robbertse
Study tour to Centre Pivot Irrigation to see mechanical irrigation equipment	1978-06-10 to 1978-07-29	USA	Mr J. Eckard
19 day study tour after the conclusion of a congress on land use planning and budgeting by objectives with regard to project registration	1978-06-05 to 1978-07-07	USA Canada	Mr R.W. Nott
To study new techniques in connection with seed potatoes	1978-06-06 to 1978-06-11	The Netherlands	Mr A.F. Visser
To collect insects for the control of hakea; to gather first-hand knowledge of overseas performance and progeny tests and the place of the South Devon breed	1978-03-28 to 1978-05-13	Australia	Mr R.L. Kluge
	1978-04-15 to 1978-05-06	England Germany	Mr J.J. Harmse
To collect insects for the control of jointed cactus	1978-06-08 to 1978-07-25	Argentina Peru Bolivia Brazil	Dr H.G. Zimmerman
To accompany a delegation from the Potato Board for discussions with importers in Mauritius		Mauritius	Mr D.C. Lourens
Study tour at the conclusion of an ACTIM course on poultry	From 21 May 1978	The Netherlands England	Mr F. Potgieter
To accompany a delegation from the Potato Board to Mauritius in connection with a consignment of seed potatoes	1978-05-10 to 1978-05-14	Mauritius	Mr B.W. Young
To hold discussions with agricultural counsellors and overseas representatives	1978-05-27 to 1978-06-16	Frankfurt Germany	Dr W.A. Verbeek
To investigate wine certification schemes and try to apply them constructively in the RSA	1978-05-30 to 1978-07-06	Germany France USA Argentina	Dr. J.D. Burger

Purpose of visit	Date	Place	SA Officer
To hold discussions with overseas representatives and investigate problems	1978-05-22 to 1978-06-20	France The Netherlands England Israel	Mr L.J. Botha
To investigate the types of seed required there, local seed supplies being exhausted	1978-08-29 to 1978-09-07	The Cape Verde Islands	Mr D.J. Crafford
Study tour to obtain information on research on plant pathology with regard to horticultural crops, especially in respect of <i>Verticillium</i>	1977-07-18 to 1977-08-20	USA and England	Mr S. Visser
To investigate methods of evaluating scion cultivars and techniques used in screening crossings from breeding programmes	1977-08-11 to 1977-09-15	USA, Canada, Germany, Italy and France	Mr W.J. Carstens
To gain information on the various aspects of vine propagation and investigate general vineyard cultural practices	36 days in 1977	USA, Canada, France, Germany and Italy	Mr J.H. van der Westhuizen
To visit a number of irrigation schemes and research institutes with a view to obtaining information on the factors that should be taken into account in the planning of irrigation schemes	1977-08-31 to 1977-09-27	USA	Mr J.A. Stofberg

ATTENDANCE AT SYMPOSIA AND CONGRESSES, AND PARTICIPATION IN STUDY TOURS

The following table reflects the number of visits by officers of the Department to African and overseas countries, and the expenditure involved, during the past six financial years:

Financial year	Visits to African States	Visits to overseas countries	Departmental expenditure	Funds made available by Boards and other bodies	Total expenditure
			R	R	R
1972/73	90	53	39 730	15 000 (a)	54 730
1973/74	56	62	60 610	30 380 (b)	90 990
1974/75	40	89	114 200	27 700 (c)	141 900
1975/76	20	91	107 790	40 985 (d)	148 775
1976/77	13	58	91 903	16 131 (e)	108 034
1977/78	26	73	111 110	50 644 (f)	161 754

(a) Expenditure in respect of 22 officers not included, since all costs were borne by the host organisations and no figures are available.

(b) Ditto in respect of 19 officers

(c) Ditto in respect of 19 officers

(d) Ditto in respect of 16 officers

(e) Ditto in respect of 16 officers

(f) Ditto in respect of 16 officers

SCIENTIFIC AND OTHER VISITORS

Name of visitor	Country and Institution	Period of visit	Purpose of visit	Institutions visited
Dr R.G. Anderson	Mexico Deputy Director of CIMMYT	1977-09-24 to 1977-10-03	To establish contacts in this country	Crops and Pastures Institute and Highveld Region
Mr R.T.F. Armstrong	Australia State Veterinarian	1977-07-01 to 1977-07-12	To inspect research	Glen, Onderstepoort and Irene

Name of visitor	Country and Institution	Period of visit	Purpose of visit	Institutions visited
Mr F. Coolman	The Netherlands President of the International Commission for Agricultural Engineering	1977-10-10 to 1977-10-24	To attend the 1977 agricultural conference and have discussions with the management at Agricultural Engineering	Agricultural Engineering
Mr. G.V. Cleary	Australia State Research Officer	1977-12-19 to 1977-12-23	To inspect livestock	Irene and Onderstepoort
Mr P. Fournier	Réunion Officer at the Institute for Research on Fruit and Grapes	1978-01-12 to 1978-01-18	To obtain information on grapes	Oenology, Citrus and Horticulture
Mr W.C. Gerrand	England Attached to the Ministry of Agriculture and Fisheries	1978-04-09 to 1978-05-03	Inspection tour	Winter Rainfall, Eastern Cape and Karoo, Natal, Transvaal and SWA Regions and Veterinary Services
Dr G. Gregory	Tasmania State Veterinarian	1977-07-22	Sightseeing tour	Onderstepoort
Dr D. Gray	Oman Chief Veterinarian of the Sultanate of Oman	1977-09-19	To collect information on animal diseases	Veterinary Services
Dr D. Gandy	USA President of the International Sunflower Association	1978-02-15 to 1978-02-20	Invited as a guest of the Department	Highveld Region
Prof A.H. Halevy	Israel Professor at the University of Tel Aviv	1977-09-06 to 1977-09-07	To conduct discussions with officers	Horticulture
Mr R. Julien	Port Louis Representative of the Emmanuel Cadet Company	August 1977	To obtain information on potato exports	Plant and Seed Control
Dr Carlos Moyano	Argentina Member of the Argentinian Organisation for Friesian Cattle	1978-01-16 to 1978-01-19	To conduct discussions	Animal and Dairy Science, Irene
Mr Y. Orev	Israel CPO at a kibbutz	1977-07-10 to 1977-07-31	To study edible crops	Karoo Region, Highveld Region, Free State Region
Dr Y. Osawa	Japan Senior Animal Health Officer	1977-11-22 to 1977-11-27	To inspect laboratory facilities	Onderstepoort
Pablo Postigo Pascual	Spain Spanish Government Consultant	1977-10-24	To visit export industries	Veterinary Services

Name of visitor	Country and Institution	Period of visit	Purpose of visit	Institutions visited
Dr A. Patterson	Australia State Veterinarian	1978-02-20	Sightseeing tour	Onderstepoort
Mr R.D. Raver	USA Dairy farmer	1978-02-14 to 1978-02-28	To obtain information and conduct interviews	Onderstepoort and Irene
Mr A.J.R. Rey	Argentina Officer of the Experimental Agriculture Organisation	August 1977	To investigate drought crops	Crops and Pastures
Dr F. Romane	France Researcher	1978-01-01 to 1978-01-14	To pool information with staff at the Botanical Research Institute	Botanical Research Institute
Dr M.J.M. Römken	USA Soil Scientist	1977-12-06 to 1978-12-08	To conduct discussions with Departmental staff	Soil Protection, Soil and Irrigation and Engineering Research Institutes
Dr S. Rachmilevitch	Israel State Veterinarian	1977-08-02	To obtain information on research at the Institute	Onderstepoort
Dr R.L. Spooner	Scotland Leader of the blood typing group in Scotland	1978-02-22 to 1978-03-01	To give a lecture to officers of the Institute	Irene (Animal and Dairy Science)
Dr G. Stanhill	Israel Director of the Soil and Irrigation Research Institute, Volcani Centre	1978-03-05 to 1978-03-19	Discussions with staff at the Soil and Irrigation Research Institute	Soil and Irrigation Research Institute
Mr P. Stonard	Australia CPO in service of State	1977-06-20 to 1977-07-04	To make a study of extension in South Africa	Transvaal, Highveld, Natal and Winter Rainfall Regions
Dr. T.Y. Tsukamoto	Canada Researcher	1978-03-15 to 1978-03-28	To pool knowledge on buckwheat	Highveld Region
Veterinarians	New Zealand Delegation to South Africa	February 1978	To do research in conjunction with local veterinarians on foot-and-mouth disease	Onderstepoort
Mr. K. Yoshioka	Japan Plant quarantine inspector	July 1977	To obtain information on citrus exports	Plant and Seed Control
Mr A.H. Bartens	The Netherlands Employed by the firm Merck and Sharp	1978-05-11	Sightseeing tour	Onderstepoort
Mr J.A. Cassels	Ireland Bacteriologist at the research laboratory at Stormount, Belfast	1978-04-27	To acquaint himself with developments in his field	Onderstepoort
Scientific group	Israel Visiting scientists	1978-05-01 to 1978-05-18	To obtain information (attendance at workshop)	Fruit and Citrus
Mr & Mrs Russel	USA Cattle farmers in Wyoming	1978-04-04	Sightseeing tour	Onderstepoort

Name of visitor	Country and Institution	Period of visit	Purpose of visit	Institutions visited
Dr P.B. Scholefield	Australia Research Scientist	1978-04-29 to 1978-05-10	To obtain information on tropical horticulture	Citrus and Horticulture
Dr A. Shimshoni	Israel Director of Veterinary Services in Israel	1978-04-02 to 1978-04-09	To study the local system of animal disease control	Onderstepoort
Mr B. Lambert and Mr A.L. Nesor	France Judges of animals	1978-04-11	Sightseeing tour after judging animals at the Rand Show	Onderstepoort
Mr A.B. Meir	Israel Director-General of the country's Department of Agriculture	1978-05-29 to 1978-06-01	Sightseeing tour	Irene, Transvaal Region, Horticulture
Nineteen farmers	New Zealand farmers	1978-05-26	Sightseeing tour	Onderstepoort
Dr J. Nolan	Australia Attached to the CSIRO	1978-05-24	Sightseeing tour	Onderstepoort
Mr A. Zariov	Cyprus Technician at an artificial insemination centre in Cyprus	1978-04-18	To obtain information on artificial insemination in South Africa	Onderstepoort
Dr H. Taylor	USA State University, Iowa	1977-09-30	Fact finding	Soil and Irrigation Research Institute
Dr I. Ravina	Israel Haifa University	1977-09-08	Fact finding	Soil and Irrigation Research Institute

REPRESENTATION ABROAD

The following table gives statistical particulars of the activities of the various overseas representatives of the Department during the year under review

Nature of activities	Europe	Washington	Canberra
1. Visits to research institutes, farms, experimental farms, etc.	155	56	74
2. Conferences and meetings attended	60	40	12
3. Special investigations on which reported	32	79	0
4. Reports and publications supplied to the Department and other organisations in the RSA	4 141	7 610	536
5. Number of visitors from South Africa			
a. for whom itineraries were supplied and the principal arrangements made	135	27	4
b. to whom general assistance was given	45	16	3
6. Interviews granted to non-South Africans	245	19	20
7. Bursary and other South African students to whom help was granted	9	12	0
8. Material sent to South Africa			
a. Plant material (number of cultivars and/or individual seed samples)	206	2 121	37
b. animal material	1 165	2	0
9. Newsletters compiled and sent to the Department	31	35	12

(4) FINANCES 1977/78

(a) EXPENDITURE (REPUBLIC)

	Vote R	Expenditure R
Administration	9 794 000,00	9 409 014,59
Plant Production Promotion	10 696 000,00	9 274 438,35
Animal Production Promotion	18 941 000,00	19 633 272,53
Agricultural Resource Utilisation	13 022 000,00	14 134 681,98
Entrepreneur Development	6 137 000,00	5 700 179,58
Supporting and Associated Services	8 322 000,00	7 830 055,94
	<u>66 912 000,00</u>	<u>65 981 642,97</u>
Less: Internal Charges	912 000,00	717 185,25
	<u>66 000 000,00</u>	<u>65 264 457,72</u>
Less: Cash discount		4 226,99
Total	<u>66 000 000,00</u>	<u>65 260 230,73</u>

(b) REVENUE (REPUBLIC)

	R
Vaccine Sales	1 962 540,59
Product Sales	1 205 502,62
Lease of State Property	136 856,72
Miscellaneous Revenue	247 086,48
Total	<u>3 551 986,41</u>
Interest on Tobacco Research Account	5 111,32
Interest on Wine Research Account	1 071,54
Interest on Agricultural Research Account	10 926,16
Total	<u>3 569 095,43</u>

(c) EXPENDITURE (SWA)

	Vote R	Expenditure R
Administration	261 000,00	235 942,66
Plant Production Promotion	355 000,00	111 983,03
Animal Production Promotion	2 725 000,00	2 677 918,22
Agricultural Resource Utilisation	3 175 000,00	2 188 086,41
Entrepreneur Development	496 000,00	451 524,14
Supporting and Associated Services	38 000,00	29 844,15
	<u>7 050 000,00</u>	<u>5 695 298,61</u>
Less: Internal Charges	5 000,00	2 980,00
Total	<u>7 045 000,00</u>	<u>5 692 318,61</u>

(d) REVENUE (SWA)

	Expenditure R
Vaccine Sales	19 383,34
Product Sales	280 349,96
Lease of State Property	11 253,81
Miscellaneous Revenue	14 908,48
Total	<u>325 895,59</u>

(5) BUILDINGS

(a) Major works completed

	R
Stellenbosch	103 918
Witriver	
Elsenburg College of Agriculture: Additions to wine cellar	
Burgershall Research Station, Citrus and Subtropical Fruit Research	
Institute: Offices and Laboratories	246 000
Onderstepoort	59 000
Gravelotte	47 000
Veterinary Research Institute: Extensions to library	
Offices for the Division of Veterinary Services	

(b) Major works under construction

Bloemfontein	686 100
Bloemfontein	492 000
Glen College of Agriculture: Research building	
Glen College of Agriculture: Additional training and hostel facilities	

Pietermaritzburg
Potchefstroom
Pretoria
Stellenbosch
Onderstepoort
Onderstepoort
Irene
Middelburg, CP
Pietermaritzburg
Stellenbosch
Vryheid

Allerton: Regional Veterinary Laboratory	361 700
Potchefstroom College of Agriculture: Office for State Veterinarian	379 700
Soil and Irrigation Research Institute: Additions	1 049 100
Plant Protection Research Institute: Additional Offices and Laboratories	389 000
Veterinary Research Institute: Building for foot and mouth research	3 060 600
Veterinary Research Institute: Alterations to existing workshop	27 000
Animal and Dairy Science Research Institute: Energy metabolism building	1 61 000
Grootfontein College of Agriculture: Administrative/Research Building	880 000
Cedara College of Agriculture: Administrative/Research Building	4 000 000
Elsenburg College of Agriculture: Administrative/Research Building	4 600 000
Offices for State Veterinarian	264 000

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(7) LEAFLET SERIES

CULTIVATED PASTURES AND FODDER CROPS

Lucerne

- A.1 Historical survey of lucerne cultivation/ *Historiese oorsig oor lusernverbouing.*
- A.2 *Beskrywing en ontwikkeling van lusern.*
- A.3 Nitrogen fixation of lucerne/ *Stikstofbinding by lusern.*
- A.4 The importance of lucerne in the farming system/ *Die belangrikheid van lusern in die boerderystelsel.*
- A.5 Adaptability of lucerne to soil and climate/ *Aanpassing van lusern by klimaat en grond.*
- B.1 Introduction to the cultivation of lucerne/ *Inleiding tot lusernverbouing.*
- B.2 Soil reaction and liming for lucerne/ *Grondreaksie en bekalking by lusernverbouing.*
- B.3 *Voedingselemente en bemesting.*
- C.2 Inoculation of lucerne/ *Inenting by lusernverbouing.*
- E.1 Water requirements of lucerne/ *Waterbehoefte by lusern.*

FIELD CROPS

Castor Oil

- A.1 The production of castor oil seed/ *Produksie en gebruik van kasteroliesaad.*
- A.2 The importance of castor oil in agriculture/ *Die plek van kasterolieverbouing in die landbou.*
- B.1 Description of the castor oil plant/ *Beskrywing van die kasterolieplant.*
- C.1 Castor oilseed cultivars/ *Kasteroliesaadcultivars.*

- C.2 Castor-oilseed: Cultural practices/*Kasteroliesaad: Verbouingspraktyke.*
- C.4 Harvesting of castor-oil seed/*Oes van kasteroliesaad.*

Cotton

- A.1 Historical review of the cotton industry.
- A.2 Composition and uses of cotton.
- B.1 Morphology and physiology of the cotton plant/*Morfologie en fisiologie van die katoenplant.*
- C.2 Cotton producing areas and trends in cotton cultivation.
- D.2 Description of cotton cultivars and their adaptation.
 - E.1.1 Seedbed preparation for cotton.
 - E.1.2 Planting time.
 - E.1.3 Plant density and spacement in cotton growing.
 - E.1.4 Planting method for irrigation cotton.
 - E.1.5 Seed treatment of irrigation cotton.
 - E.1.6 Irrigation of cotton.
 - F.1 Chemical composition of cotton.
 - F.2 Nutrient uptake in cotton.
 - F.3.1 Fertilizer requirements of irrigated cotton.
 - G.1.1.2 Control methods for cotton pests/*Beheermetodes by katoenplae.*
 - G.1.1.3 *Katoenplae: Toedieningsapparaat en metode.*
 - G.1.1.4 Pesticides for cotton cultivation/*Plaagdoders vir katoenverbouing.*
 - G.1.1.5 Spraying programme for cotton pests.
 - G.1.2.1 *Myte op katoen: bio-ekologie en beheer.*
 - G.1.3.1 Eelworms on cotton: Bio-ecology and control/*Aalwurms op katoen: Bio-ekologie en beheer.*
 - G.2.1.1 Damping-off diseases of cotton.
 - G.2.1.2 Angular leaf spot in cotton.
 - G.2.1.3 Verticillium wilt in cotton.
 - G.2.1.4 Alternaria leaf spot in cotton/*Alternaria-blaarvlek by katoen.*
 - G.2.2.1 (Red death) in cotton/*"Rooidood".*
 - G.2.2.2 Shedding of squares and young bolls in cotton.
 - G.2.2.3 Deficiency diseases of cotton.
 - G.3.1 Importance of weeds on cotton fields.
 - G.3.3 *Onkruidbeheer tydens en na saadbed-voorbereiding.*
 - H.2.1 Efficient hand-picking of cotton.
 - H.2.2 Chemical defoliation of cotton.
 - H.2.3 Mechanical picking of cotton.
 - H.3.1 Artificial drying of seed cotton.
 - H.4.1 Cotton bales.
 - H.4.2 Small-scale handling of cotton/*Losmaathantering.*
 - I.1 Cotton: marketing organisation.
 - I.2 Cotton grading.
 - J.1 Cost budget for cotton.
 - J.2 Production costs of cotton in different agro-ecological areas.

Groundnuts

- C.1 Sellie - A groundnut cultivar for South Africa/*Sellie - 'n Grondbooncultivar vir Suid-Afrika.*
- D.6 *Bepaling van plantdatum by grondbone.*
- D.9 *Die uitwerking van grond en reënval op droëlandopbrengs van grondbone in die Hoëveldstreek.*
- H.4 *Meganiese oes van grondbone.*

Maize

- G.3 *Kunsmatige droging van mielies.*
- H.5 Structural changes in farming in the Western Transvaal/*Struktuurveranderinge in boerdery in Wes-Transvaal.*
- H.6.1 Maize: General farming results in the North-Western Free State 1976/77/*Mielies: Algemene boerderybedryfresultate in die Noordwes-Vrystaat 1976/77.*

Potatoes

- C.2 Influence of rainfall and soil on potato yields in the Hiveld Region/*Die invloed van reënval en grond op aartappelopbrengste in die Hoëveldstreek.*
- G.13 Nematode pests in potatoes/*Aalwurmplae by aartappels.*
- H.4 Mechanical damage during the potato harvesting process/*Meganiese beskadiging tydens die aartappeloes.*
- H.5 Mechanical damage to potatoes/*Meganiese beskadiging van aartappels.*

Sunflower

- E.1 Boron deficiency in sunflowers/*Boortekort by sonneblom.*

Wheat

Wheat cultivation in the Summer Rainfall Area

- D.1 Cultivar recommendations for the Eastern Free State.
- D.4 Koringverbouing, cultivaraanbevelings vir die Springbokvlakte en omgewing.
- G.2 *Plantplaagbeheer op die Springbokvalkte.*
 - G.3 Weed control in small grain in the Summer Rainfall Region/*Onkruidbeheer by kleingraan in die somerreëng gebied.*
- J.2 General farming results: Wheat - Eastern Free State, 1976-1977.

DECIDUOUS FRUIT

Apples

- B.3 The replant problem in apples/*Die hervestigingsprobleem by appels.*
- C.6 Growth regulators in apple production/*Groeireguleerders by appel-verbouing.*
- H.3 Packing of apples/*Verpakking van appels.*
- H.4 Maturity standards for apples/(K)*Rypheidsstandaarde vir appels.*

Guavas

- H.1 Guava pests/ *Koejawelplae*.

Peaches

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- E.4 Cultivation of vineyards/ *Bewerking van Wingerde*.

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- C.1.2.2.1 Plantecological principles in the veld management of beef cattle farming/ *Vleisbeeste: plantekologiese beginsels by weiding.*
- C.1.2.2.2 Beef cattle: Factors affecting pasture plant succession/ *Vleisbeeste: Faktore wat plantopvolging beïnvloed.*
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- C.1.2.3.4 Grass growth and grazing management in beef cattle farming.
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- D.1.5 Beef cattle farming in the Winter Rainfall Region/ *Vleisbeesboerdery in die Winterreënstreek.*
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- B.1 Genetic aspects of dairy-cattle breeding/ *Genetiese aspekte van melkbeesteelt.*
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- H.1 The flaying, curing and grading of skins/ *Die afslag, bereiding en gradering van velle.*

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(9) NEW LEGISLATION 1977/78

Fencing Amendment Act, 1978 (Act 4 of 1978).

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